

Renewable Energy Technology for Education and Research

For Schools, Vocational Schools, Universities and Research Institutes

ACADEMIA OFFERING



Fuel Cells

Energy Management

E-Mobility

Renewable Energy Efficiency

Power to Go



Heliocentris Academia International

Your Partner for Instruction in Renewable Energies, Energy Storage and Energy Management.

ACADEMIA OFFERING

Knowledge about renewable energies and their storage have become a permanent fixture in our lives and will play an even greater role in the future. The education of students in this technology is a central element of our mission.

Heliocentris training products help students at schools, universities and research institutions to understand key concepts regarding renewable energy, energy management and energy storage. You will bring students closer to these complex technologies, while achieving the desired learning outcomes in a fun and interesting way. Heliocentris products will pique the interest of students and assist instructors in the key areas of Science, Technology, Engineering and Mathematics. Each product includes well written manuals, instructional material and software that is tailored to the key topics covered by the system. While the curriculum topics vary, they help give students the required knowledge to understand renewable energy systems.

Our products stand for:

- » Curricular relevance and didactic quality
- » Measurement precision and excellent workmanship
- » High quality products and robust construction
- » Simple and fast commissioning and operation
- » Versatile areas of application in chemistry, physics and electrical engineering
- » Target-group-specific documentation and experiments for students

Heliocentris Academia International

Training Products for Schools, Universities and Research Institutes

SCHOOL LEVEL

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ADVANCED - HIGH EDUCATION

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RENEWABLE ENERGY LABORATORY SOLUTIONS

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ACCESSORIES

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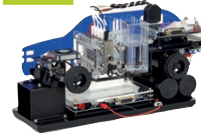
OVERVIEW

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04



09



05



11



06

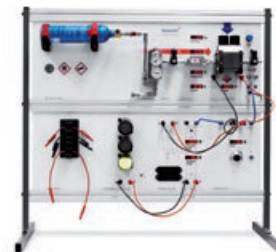


08

NEW



10



12



13



14



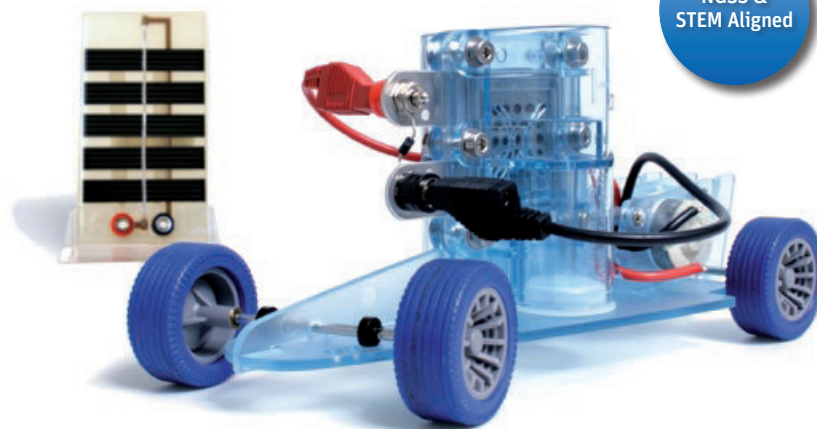
Model Car

A Science & STEM Focussed Solar & Hydrogen-Fuel Cell Car Kit

Powered by water and sunlight, the Model Car is a vivid introduction to the topic of renewable energies. With pre-configured experiments and a curriculum-oriented instruction manual, the contents of solar, hydrogen and fuel cell technology can be easily communicated.

The Model Car is distinguished by its flexible and durable construction and can be used for individual or group work. The numerous experiments can be practically implemented for current topics such as energy storage and alternative drives.

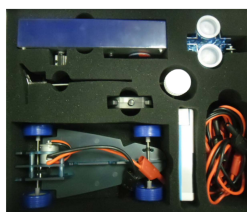
NGSS &
STEM Aligned



Key Features

- » Design of fuel cells and solar cells
- » How to measure the current and the voltage of the fuel cell
- » Up to 5 students can work with the Model Car at the same time
- » Suitable for communicating subject matter from physics, chemistry and technology curricula
- » CO₂-free mobility
- » Energy Storage and use of renewable energies
- » Chemical reactions of the entire energy conversion chain (e.g. water to hydrogen and oxygen)
- » Hydrogen generation by means of electrolysis via solar module or hand generator

COMPONENTS



STORAGE BOX



REVERSIBLE FUEL CELL



SOLAR PANEL



CHASSIS



HAND GENERATOR*



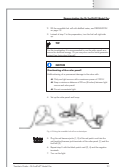
LOAD MEASUREMENT
BOX*



INSTRUCTION MATERIAL
WITH EXPERIMENT GUIDE & CD

Sample Experiments

- » Energy conversion
- » How to measure the current and the voltage of the fuel cell and electrolysis
- » Hydrogen generation by means of electrolysis via solar module or hand generator
- » Load measurement box for measuring current and voltage
- » Characteristic curves of current and voltage
- » Measurement of electrical charge
- » Various load settings possible for measuring the effect on current and voltage
- » Design of solar cells and fuel cells
- » Influence of illumination intensity and cell shading on the behavior of solar cells
- » Generation of electrical energy



Product Options

Model Car Complete

The measurement box enables quantitative investigations. Power can be generated with the hand generator as an alternative to the solar module

- » Reversible fuel cell
- » Solar panel
- » Chassis
- » Instruction material with Experiment Guide in ring binder + CD
- » Bottle with distilled water
- » Cable set
- » Load measurement box*
- » Hand generator*

Art. no. 354

Model Car Demo

Numerous simple demonstration experiments for physics, chemistry and technology lessons

- » Reversible fuel cell
- » Solar panel
- » Chassis
- » Instruction material with Experiment Guide in USB + CD
- » Bottle with distilled water
- » Cable set

Art. no. 352

Accessories

Lamp

Lamp for operating the solar cell

Art. no. 314

Dimensions (W x H x D): 345 x 160 x 280 mm, weight: approx. 2.9 kg.
*Only included with Model Car Complete.

Model Car
is available
as bundle.
Page 7

Science Kit

A Science & STEM Focussed Solar & Hydrogen-Fuel Cell Kit

The Science Kit is an extensive experiment set for the subject of renewable energies. 20 pre-configured experiments and extensive accompanying materials make it a complete solution for physics and chemistry lessons.

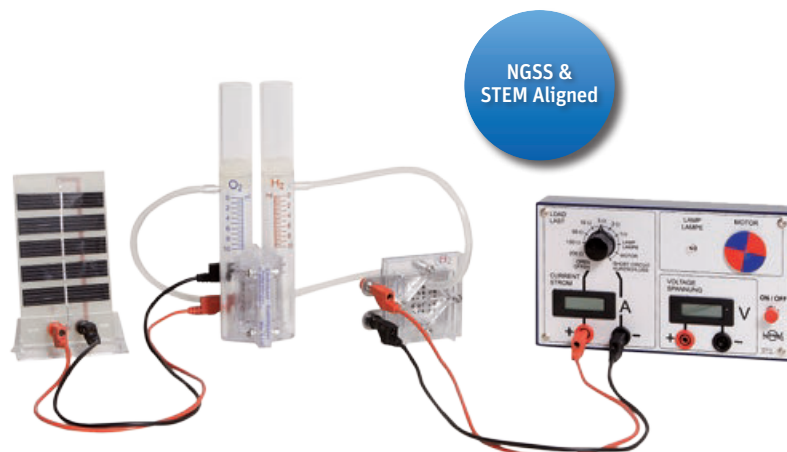
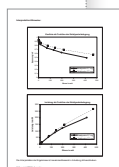
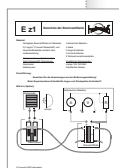
The components form a complete solar-hydrogen energy conversion chain and can be flexibly combined with one another. The topic of renewable energies can be approached in consideration of the entire conversion chain or on the level of the individual technologies, such as photovoltaics or fuel cells. All components can be used and investigated separately.

Key Features

- » Basic design of fuel cells and solar cells
- » Up to 5 students can work with the Science Kit at the same time
- » Suitable for communicating subject matter from physics, chemistry and technology curricula
- » Energy Storage and use of renewable energies
- » Chemical reactions of the entire energy conversion chain, e.g. water to hydrogen and oxygen or methanol to carbon dioxide and current
- » Hydrogen generation by means of electrolysis via solar module or hand generator
- » Conversion of solar energy to electronic energy and hydrogen
- » Increase of efficiency of fuel cells
- » Use of stored energy
- » Separation of water into hydrogen and oxygen

Sample Experiments

- » Examination of solar cells and their efficiency
- » How to determine the tilt angle of solar cells
- » How many solar cells supply a house?
- » Investigation of water electrolysis – how is water separated?
- » Investigation of the electrolyzer: Does current increase when the voltage is increased?
- » Examination of a hydrogen and methanol fuel cell
- » How does the green house effect work?
- » Examination of efficiency in the system
- » Investigating electrolyzers and fuel cells
- » Hydrogen as an energy carrier and storage
- » How to create a characteristic curve of an electrolyzer and of a hydrogen and methanol fuel cell
- » Calculating the Faraday efficiency of an electrolyzer



NGSS & STEM Aligned

COMPONENTS



STORAGE BOX



FUEL CELL



LOAD MEASUREMENT BOX



METHANOL FUEL CELL*



FUEL CELL COMPONENTS*



INSTRUCTION MATERIAL WITH EXPERIMENT GUIDE AND CD

Product Options

Science Kit Complete

Basic experiments and in-depth experiments for various fuel cell types

- » Electrolyzer
- » Fuel cell
- » Solar panel
- » Load measurement box
- » Instruction material with Experiment Guide + CD
- » Take-apart fuel cell*
- » *Methanol fuel cell**

Art. no. 355

Science Kit Demo

A variety of basic experiments for physics, chemistry or technology lessons

- » Electrolyzer
- » Fuel cell
- » Solar panel
- » Load measurement box
- » Instruction material with Experiment Guide in USB + CD

Art. no. 350

Accessories

Lamp	Lamp for operating the solar cell	Art. no. 314
Hand generator	Hand generator for manual production of hydrogen	Art. no. 345

Dimensions (W x H x D): 430 x 150 x 310 mm, weight: approx. 5.6 kg.

*Only included with Science Kit Complete.

Science Kit is available as a bundle. Page 7

Professional

Focused on Science, Engineering (STEM) & Renewable Energy Topics

The Professional Training System forms a complete solar-hydrogen energy circuit. Electric current is generated by a solar cell, stored by means of electrolysis and converted back in a fuel cell which supplies a consumer.

The Professional Training System supports you in presentations to the class. Solar technology and fuel cells can be investigated in detail. Large components and easy-to-read displays are ideal for group presentations.

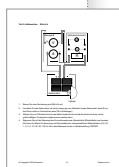
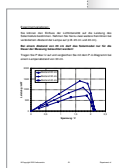
Pre-configured experiments and comprehensive documentation simplify lesson preparation.

Key Features

- » Demonstration unit for classroom-style teaching
- » Suitable for communicating subject matter from physics, chemistry and technology curricula
- » Basic design of fuel cells and solar cells
- » How to measure the current and the voltage of the fuel cell and electrolyzer
- » Energy storage and use of renewable energies
- » Chemical reactions of the entire energy conversion chain
- » Water to hydrogen and oxygen
- » Hydrogen generation by means of electrolysis via solar module or hand generator
- » Quick guide for fast commissioning
- » Complete energy conversion chain from solar energy to hydrogen and into electrical energy again
- » Observing increased efficiency of fuel cells

Sample Experiments

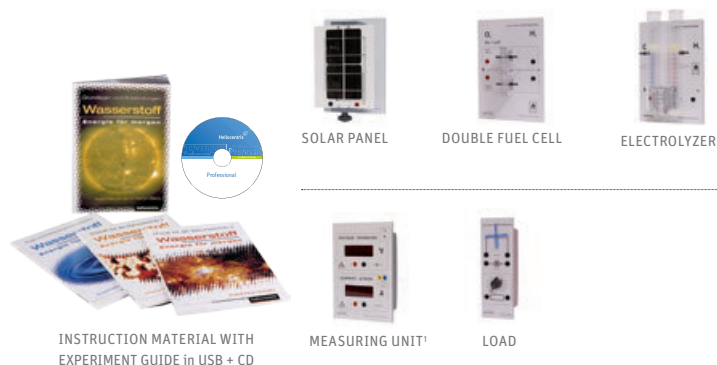
- » Examination of solar cells and their efficiency
- » How to determine the tilt angle of solar cells
- » How many solar cells supply a house?
- » Investigation of water electrolysis:
How is water separated?
- » Investigation of the electrolyzer – does current increase when the voltage is increased?
- » Examination of a hydrogen and a methanol fuel cell
- » How does the green house effect work?
- » Examination of efficiency in the system
- » Investigating electrolyzers and fuel cells
- » Hydrogen as an energy carrier and storage
- » Characteristic curve of an electrolyzer and a hydrogen fuel cell
- » Calculating the Faraday efficiency of an electrolyzer



NGSS & STEM Aligned

not included

COMPONENTS



INSTRUCTION MATERIAL WITH
EXPERIMENT GUIDE in USB + CD

SOLAR PANEL

DOUBLE FUEL CELL

ELECTROLYZER

MEASURING UNIT¹

LOAD

Product Options

Professional Complete

Visualization of measurement data by the measuring unit

- » Solar panel
- » Electrolyzer
- » Double fuel cell
- » Load
- » Instruction material with Experiment Guide + CD
- » Measuring unit¹

Art. no. 392

Professional Demo

Numerous descriptive demonstration experiments for physics, chemistry and technology lessons

- » Solar panel
- » Electrolyzer
- » Double fuel cell
- » Load
- » Instruction material with Experiment Guide in USB + CD

Art. no. 391

Accessories

Lamp

Lamp for operating the solar cell

Art. no. 314

Dimensions (W x H x D): 600 x 840 x 460 mm, weight: approx. 10.1 kg.

¹ Measuring unit only included with Professional Complete.

Classroom Sets and Instruction Material

The affordable offer for the entire class.

The classroom sets are designed for use by six groups of four students each.¹

Professional Complete Bundle



Includes the Professional Complete for presentations to the class.
It is based on the same didactic concept as the included Science Kits.

Art. no. 927

Professional Demo Bundle



Includes the Professional Demo (without measuring module) for presentations to the class. It is based on the same didactic concept as the included Science Kits.

Art. no. 915

*Without instruction material.

¹ One set of Instruction Material is included in each set.

Lamp not included, has to be ordered separately.

Science Kit Basic Bundle



Includes the Science Kit Basic for experiments together with the class.

Art. no. 916

Model Car Complete Bundle



Includes the Model Car Complete for experiments together with the class.

Art. no. 926

*Without instruction material.

¹ One set of Instruction Material is included in each set.

Lamp not included, has to be ordered separately.

HYBRID RENEWABLE ENERGY TRAINER

Experiment Set for Energy Production, Energy Storage and Energy Supply

The modular Hybrid Renewable Energy Trainer demonstrably shows your students the complete chain of renewable energy production (from wind and solar) and hydrogen-based energy storage. Various climate and consumption profiles corresponding to the components in use can be selected in the learning and experimentation software. The content of the training set is applicable for advanced technical training, including basic training.

- » Control and generation of electrical energy and the management of these processes
- » Comprehensive documentation and experimentation in the fields of chemistry, physics and electrical engineering with experiments and their explanation, as well as the instructor solution set

Software

- » Visualization of operating parameters in tables and graphs
- » Generation of characteristic curves and data export

Sample Experiments

- » Explore properties, efficiency and characteristic curves of the Solar Module, Wind Generator and Fuel Cell
- » How to optimally align renewable energy sources: Which energy source generates the most hydrogen?
- » Chemical reaction of water during electrolysis: How to generate hydrogen with renewable energy sources
- » Applying Faraday's first law to fuel cells



NEW
modular
training
system



SOFTWARE

6) Set the sample circuit on the LabView Block Diagram window as seen in Figure-3.



Figure-3

7) Double click on DAQ Assistant icon and make the relevant settings on the window as shown in Figure-4.



Figure-4

- 8) Gradually increase the SPEED potentiometer and observe the change in the output signal figures.
9) Set the SPEED potentiometer at level 6. Draw the signal figures as seen on the computer in Graphic-1.

Product Overview

Hybrid Renewable Energy Trainer

- | | |
|--------------------------|---|
| » 1x Wind generator | » USB data monitor |
| » 2 x Solar module | » PC software |
| » 1 x Electrolyzer | » Anemometer |
| » 1x Fuel Cell stack 30W | » Radiation meter |
| | » Instruction Manual and Experiment Guide + USB |

Art. no. 2000-2055

Optional components:

Isolated measurement module; Monophase switching module;
Data acquisition module; ON-GRID Inverter module

Accessories

Module stand (NOT MOBILE)
LCD Monitor; Monitor Holder

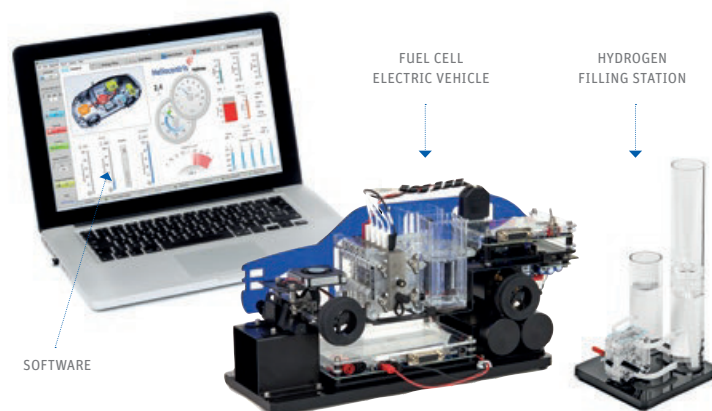
HyDrive – Electric Vehicle Trainer

Experiment Set for Teaching Hydrogen Fuel Cell Technology in Electric Vehicles

IN REDISIGN

*Notebook not included

The HyDrive provides students with a hands-on experiment set to examine the construction, functionality and benefits of fuel cell and hybrid electric vehicles. The Electric Vehicle Trainer assists teachers in conveying the scientific principles behind this technology. The HyDrive comes with an extensive didactic material and an educational software, facilitating teacher's preparation and execution of classes.



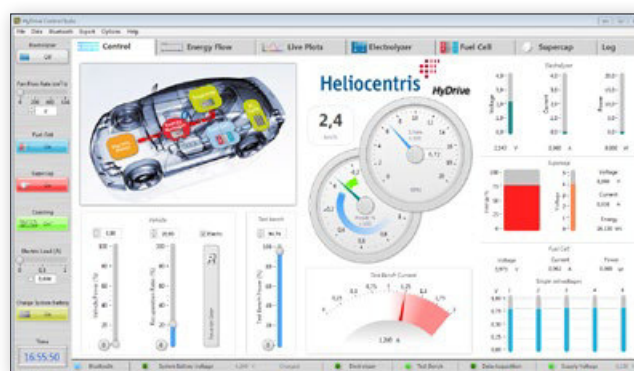
Key Features

- » FCEV vehicle that can be operated independently or in conjunction with a test bench
- » H₂ filling station to demonstrate safe vehicle refueling
- » The modular set-up allow users to examine separate subcomponents or the complete hybrid system
- » Actual components for real qualitative and quantitative analyses - no simulation
- » Highly-advanced didactic software
- » Extensive experiment guide with >15 experiments that facilitates autodidactical study and problem resolution

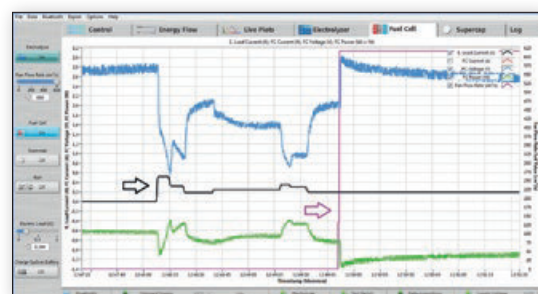
Software

The educational software facilitates system control, and monitoring, data acquisition and graphical representation of the collected data. The software visualizes vehicle component interaction, the conversion of one energy type to another, flow direction and state. It displays whether the vehicle is consuming or recuperating energy and allows users to configure a variety of drive cycles and load profiles, e.g. inner city stop & go, highway, uphill or downhill etc..

SOFTWARE



System overview



Characteristic of a fuel cell

Experiments

Basic experiments:

- » Charge and discharge characteristics of a supercapacitor
- » Characteristic curve of a fuel cell and electrolyzer
- » Basic equation of motion
- » Conversion of electrical to mechanical power

Application-oriented experiments

- » Recuperation of braking energy
- » Constructing and testing a hybrid system

Includes Teaching Materials



Product Overview

HyDrive

- | | |
|---|-------------------------------------|
| » Model Car | » Test Bench |
| » Take-Apart Fuel Cell Stack | » Fan |
| » 2 x Hydrogen Tanks à 30 cm ³ | » Software |
| » Energy Control Board | » Experiment Guide & Teachers Guide |
| » Hydrogen Filling Station | » USB |
| » Supercapacitor | » Accessories e.g. Tubes and Cables |

Art. no. 1000

Fuel Cell Trainer

50 W Fuel Cell Training System for Teaching Basic Engineering Principles

The Fuel Cell trainer is ideally suited for teaching the basic engineering principles of PEM fuel cell systems. Extensive experimenting capabilities and comprehensive instruction material with predefined experiments make it a complete instruction package.

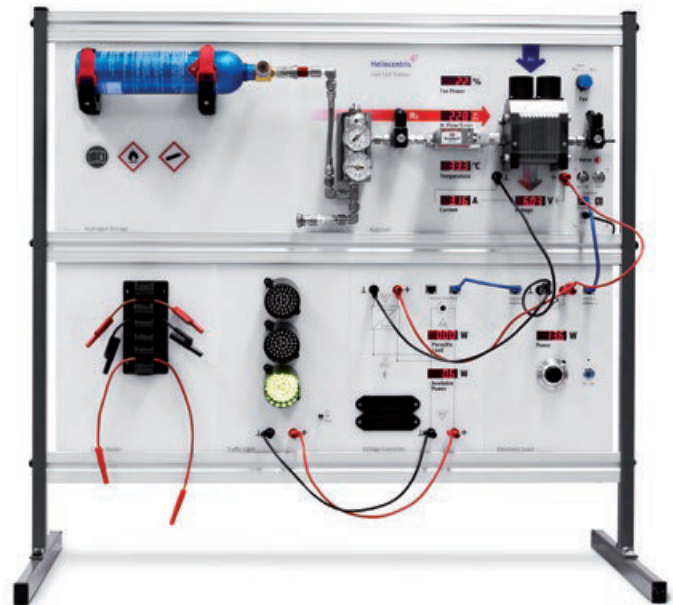
All components of the fuel cell system are represented individually and can be examined easily. The supplied software enables your students to conduct experiments and measurements.

Key Features

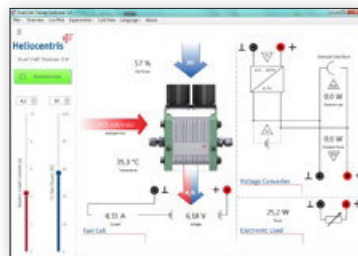
- » Optimized instruction material for teachers and students
- » 50 W PEM fuel cell with modular system design and upgrade options
- » Extensive measuring technology and data acquisition via PC interface
- » Convenient experimentation software and measurement data acquisition
- » Integrated safety monitoring also for inexperienced users

Software

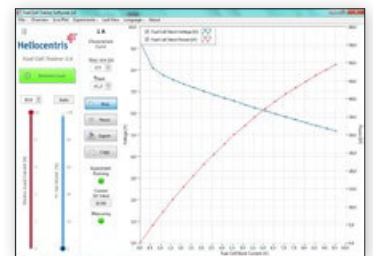
- » Visualization of the physical system
- » Real-time monitoring and plotting of system parameters: e.g. hydrogen flow, fuel cell stack temperature, current and voltage
- » Automatic experimentation mode for instant graph plotting and evaluation
- » Manual experimentation mode for data generation and in-depth analysis of load profiles and various influencing factors



SOFTWARE



System Overview

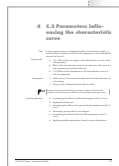


Automatic experimentation mode

Experiments:

Basic experiments:

- » Characteristic curves and efficiency curves
- » Dependence of output on temperature and air supply
- » Hydrogen / current characteristic curve
- » Calculating the efficiency of the fuel cell stack



Application-related experiments:

- » System efficiency of a fuel cell system
- » Independent power supply and working range of a fuel cell
- » Sample application for fuel cell car: fuel consumption and load profile



Product Overview

Fuel Cell Trainer

- » Fuel cell module
- » Electronic load
- » DC voltage converter module
- » Traffic light module
- » H₂ storage module
- » Instruction material with Experiment Guide in ring binder
- » Software + CD



Art. no. 693

Accessories: Hydrogen supply – 200 bar H₂ connection kit

Pressure reducer for filling the hydrogen storage canister in the H₂ storage module
Dimensions (W x H x D): 910 x 840 x 460 mm, weight: 20 kg.

Art. no. 631

Hydrogen generator HG-30

Art. no. 1306

Nexa® Integration System

From Theory to Practical Application

The Nexa® Integration System is ideal for demanding application projects. The Nexa® 1.2kW fuel cell power module has been designed as a very durable and reliable system to ensure success with training and research projects. The system uses a DC/DC converter optimized for the module and a software package for easy control of all components.

The system prepares regulated DC voltage and enables simple hybridization with batteries. Open interface and comprehensive configurability of the individual components simplify the integration and guarantee optimal performance.

Key Features

- » Easy to integrate and operate
- » Easy to hybridize with batteries and other energy sources
- » High efficiency and high reliability due to safe setup of the system
- » Easily accessible interfaces make the system easy to interact with

Software

- » System Overview
- » Efficiency Analysis
- » Time Curve
- » Freely configurable measurements
- » Visualization of characteristic curves

“The Nexa® 1200 is a very maintenance-friendly fuel cell and is outstandingly well-suited for mobile applications, thanks to its reliability.”

Thomas Pohle, Head of Service Operations, Heliocentris



Includes Software

Nexa® 1200

The Nexa® is a versatile 1.2 kW fuel cell module tailored to the requirements of system integration.



Includes Software

Nexa® DC1200

The Nexa® DC 1200 transforms the non-regulated output voltage of the fuel system to 24/48 V DC voltage and enables simple realization of battery hybridization.

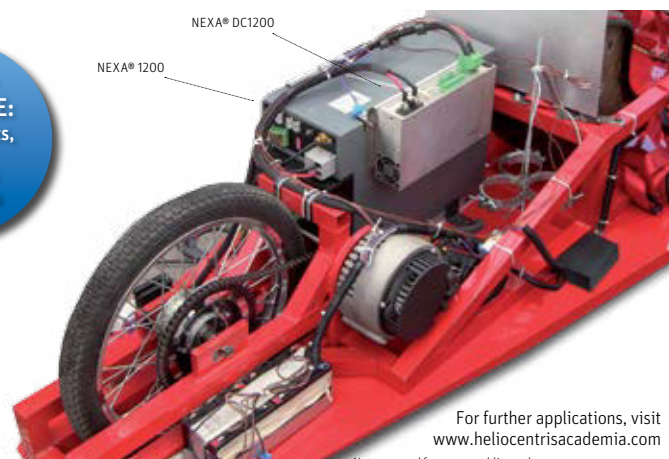


Nexa® OSC Software – For the perfect setup of components

The Nexa® OSC software can be used for efficient overall system control of the Nexa® 1200 and Nexa® DC1200. Data from all components can be centrally parameterized and visualized.

APPLICATION EXAMPLE

EASY TO INTEGRATE:
Go-carts, boats, backups, automobile applications



For further applications, visit
www.heliocentrisacademia.com
Not approved for use on public roads.

Product Overview

Nexa® 1200

- » 1.2 kW fuel cell module
- » Monitoring and control software
- » Startup kit

Art. no. 1911*

Nexa® DC1200

- » DC converter
- » 24 V
- » 48 V

Art. no. 1610

Art. no. 1611

Nexa® OSC Software

- » Software package for the overall system control

Art. no. 1870

* Only available in combination with a hydrogen connection kit from Heliocentris.

Accessories and hydrogen supply available on request.

Hybrid Energy Lab-System

1.2 kW Fuel Cell and Battery Hybrid System for Laboratory Application

On request
with integrated
HG
*With API

Includes
Instructional
Materials

A Fuel Cell – Battery Hybrid System that enables users to understand & research individual components and system behavior under various hybrid set-ups. Designed as a lab to support engineering courses focussed on the application of fuel cells, battery technology, hybrid systems, energy management and energy storage.

Ideal for Courses Focused On:

- » Battery Technology (Modeling)
- » Battery Systems & Control
- » Applied Fuel Cell Technology
- » Battery- Fuel Cell Hybrids
- » Electrochemical Energy Storage & Conversion
- » Renewable Energy Storage
- » Electrical & Hybrid Vehicles (HEV/FCEV)
- » Backup Power Systems

The system provides an experimental platform for advanced training to applied research:

- » Fuel Cell – Battery Hybrids
- » Battery Charging/Discharging
- » Battery & Fuel Cell Model Analysis & Comparison
- » Calculation & Evaluation of Electrical Characteristics
- » Energy Management
- » User Developed Control Algorithms
- » Validation of Models Against a Real System
- » Hybrid Power System Set-ups: UPS, Autonomous Power Supply, Back-up Power System, HEV/FCEV

Software

- » System Overview
- » Efficiency Analysis
- » Time Curve
- » Freely configurable measurements
- » Visualization of characteristic curves
- » Selection of manual and automated experiments

Sample Experiments

- » System design for special applications: Backup, Emergency power supply (UPS), Autonomous power supply, Boost, range extender
- » Examination of the operating behavior of: Battery module, Fuel cell module, DC converter
- » Determination of the efficiency and energy conversion
- » Examination of load step changes of up to 1.5 kW
- » Generation of characteristic curves



135 cm



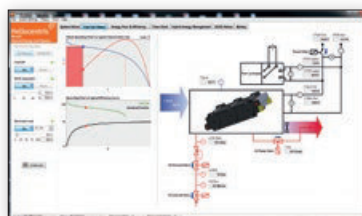
Fuel Cell Stack



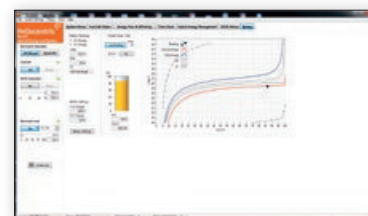
Metal Hydrogen Canister



SOFTWARE



Fuel Cell & H₂ System



Battery charging/discharging behavior

Product Overview

Hybrid Energy Lab-System

- | | |
|---------------------------------|--|
| » Fuel cell module | » System control module |
| » Power management module | » Measurement and experimentation software |
| » Electronic load module | » All-in-one PC incl. keyboard, mouse |
| » Battery module | » Instruction and experimentation material |
| » H ₂ storage module | |

Art. no. 793*

Accessories*: Hydrogen supply – 200 bar H₂ connection kit

Dimensions (W x H x D): 600 x 1,350 x 600 mm, weight: approx. 150 kg.
*Only available in combination with a hydrogen connection kit from Heliocentris.

Hydrogen Generator 72nl/h-198nl/h

Art. no. 1303-1304

Solar Hydrogen Trainer

Mobile Laboratory for Hydrogen Generation with Solar Energy

Optional
Solar Tracker

Includes
Teaching
Materials

The Solar Hydrogen Trainer is a training system for generating hydrogen by means of an electrolyzer, which is powered by two photovoltaic modules. Performance and generation data of the PV modules, power electronics, battery and electrolyzer are captured and displayed in the included LabVIEW based software.

The system is designed to be combined with additional Heliocentris products, such as the Fuel Cell Trainer or Hybrid Energy Lab-System. The components of the system are mobile and can be connected or disconnected quickly. The supplied documentation supports instructors in lesson planning.

Key Features

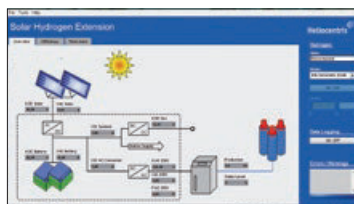
- » Mobile Laboratory For Solar Hydrogen Generation
- » Electrolyzer and PV system can be used separately
- » LabVIEW based Software for system control, system monitoring and data acquisition
- » Extensive instruction material and Experiment Guide
- » User-friendly, easy-to-operate
- » Remote monitoring via LAN network is possible
- » Can be combined with other systems like Fuel Cell Trainer and Hybrid Energy Lab-System

Software

- » System overview and control of components
- » Overall system efficiency analysis
- » Freely configurable measurements
- » Overall system output balancing
- » System efficiency chain (Sankey diagram) and flow chart
- » Voltage and current display for individual components



SOFTWARE



System Overview



Measurements

Learning Objectives

- » Basic principles of photovoltaic power production and storage
- » Functional principle of an autonomous solar system
- » Determining the efficiency of solar hydrogen generation
- » Design of a solar hydrogen system
- » Mobile system technology unit
- » Hydrogen generator



Product Overview

Solar Hydrogen Trainer

- » Mobile unit with solar system components
- » 2x mobile photovoltaics module
- » Hydrogen generator with interface
- » Monitoring and control software
- » Cable set

Solar Trainer PV-version (without hydrogen generator) **Art. no. 810**

Solar Hydrogen Trainer with HG 72NI/h **Art. no. 812**

Accessories

PV sensors: radiation, module and ambient temperature **Art. no. 821**

H₂ storage canister – metal hydride storage canister 800 NI **Art. no. 650**

New Energy Lab

Renewable Energy Smart Grid
for Training & Applied Research

The New Energy Lab is a full-fledged energy system for conveying practical knowledge in the field of energy management. The system combines renewable energy generation from solar, wind and fuel cell power with modern energy storage technology.

The New Energy Lab enables the exploration of various energy sources in combination with the battery system or electronic load. The Monitoring and Control Software enable your students to optimally evaluate system data.

Key Features

- » Laboratory for solar, wind, hydrogen and fuel cell technology
- » Set-up of hybrid system with solar, wind, hydrogen and fuel cell technology, as well as batteries
- » High reliability and safety
- » Comprehensive system software

Software

- » System overview, control and explanation of components
- » Efficiency analysis of the overall system and the individual components
- » Freely configurable measurements
- » Output balancing of the overall system and the individual components
- » System efficiency chain and flow chart
- » Voltage and current display for individual components
- » Monitoring of the hydrogen circuit
- » Creating and saving load profiles

System includes

- » Solar system: 1,500 W_p
- » Small wind power module: 300 W_p
- » Fuel cell module: 1,200 W
- » Battery bank: 55 Ah
- » Electrolyzer: 72 NI/h optional on request 198 NI/h
- » Low-pressure metal hydride canisters: approx. 750 NI
- » Electronic load: 2,400 W
- » Central energy management unit
- » System controller with monitoring and control software
- » Measuring technology, such as anemometer, H₂ flow meter
- » On Grid inverter

Accessories

- » Solar Tracking System alternative to the mobile version
- » Extra Sensor Kit optional

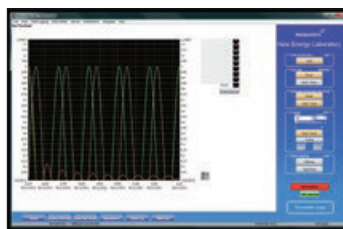
With API
On-Off-Grid
System

Optional
Solar-Tracker

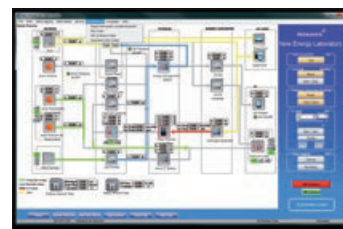


SOFTWARE

Art. no. 880



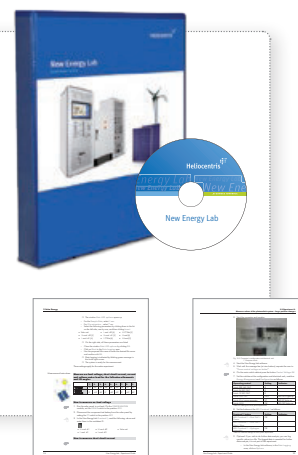
Measurements



System Overview

Learning Objectives

- » Introduction to solar, wind, hydrogen and fuel cell technology
- » Design of hybrid systems
- » Energy management and operation of hybrid systems
- » Autonomous operation of real loads
- » Scenario analysis: night-time operation, periods of no wind, peak loads



Power-to-Gas Laboratory

Investigate the entire energy conversion chain – energy harvesting, conversion and storage in the form of hydrogen and consumption by a load. We provide extensive consultation for equipping your laboratory.

Combine the Solar Hydrogen Trainer with the Fuel Cell Trainer or Hybrid Energy Lab-System to build your own autarkic Power-to-Gas Lab.



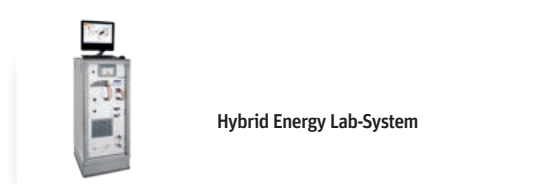
Solar Hydrogen Trainer



Metal hydride storage canister



Fuel Cell Trainer



Hybrid Energy Lab-System

Hydrogen Supply

For Fuel Cell Modules and Training Systems



HG Series Hydrogen Generators

The HG series hydrogen generators enable the production of the purest hydrogen (99.9999 %) and are suitable for direct operation of fuel cell systems and for filling metal hydride storage canisters.

The maintenance-free generators are available with a production capacity of 24 to 198 NI/h and are designed for continuous operation. The Input/Output board enables control via PC and an expansion of the product capacity by means of cascading up to 10 generators.

Product Options	
HG30	Art. no. 1306
HG72 - HG198	Art. no. 1303-04
Optional remote control software	Art. no 1307

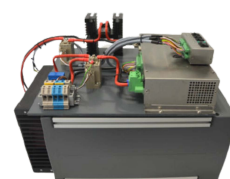


Metal Hydride Storage Canisters

Metal hydride storage canisters operate at low pressures from 10 to 17 bar and enable the safe storage of larger quantities of hydrogen.

With various canister capacities (200, 400 and 800 NI) and the possibility of connecting multiple canisters, the capacity can be increased. The quick coupling connector of the canister assures simple and safe coupling and uncoupling.

Product Options	
MHS200	Art. no. 648
MHS800	Art. no. 650



NIS Nexa Integration System

Article no. 1911

Nexa® 1200
Nexa® DC1200
Nexa® OSC Software

H₂ Connection Kit



Pressure reducer for direct operation of fuel cell modules or re-filling metal hydride storage canisters from 200 bar compressed gas cylinders.

Article no. 631

200 bar connection kit with safety valve

Article no. 736

Hydrogen Detector



The portable hydrogen warning device (0 – 100 ppm) for monitoring of the workplace in combination with a leak detection liquid assure safety when working with hydrogen.

Article no. 731

Our products

Product	Art. no.	Article	Page
SCHOOL LEVEL			
Model Car			Page 04
	352	Model Car Demo*	
	354	Model Car Complete*	
	926	Model Car Complete Bundle of 6 units	
	Accessories		
	314	Lamp for operating the solar cell	
	345	Hand generator for manual production of hydrogen	
	358	Load measurement box	
Science Kit			Page 05
	350	Science Kit Basic*	
	355	Science Kit Complete *	
	916	Science Kit Basic Bundle of 6 units	
	924	Science Kit Complete Bundle of 6 units	
	Accessories		
	345	Hand generator for manual production of hydrogen	
	314	Lamp for operating the solar cell	
	353	Take-apart fuel cell	
	357	Methanol fuel cell	
Professional			Page 06
	391	Professional Demo	
	392	Professional Complete	
	915	Professional Demo Bundle	
	927	Professional Complete Bundle	
	Accessories		
	314	Lamp for operating the solar cell	
ADVANCED - HIGHER EDUCATION			
Hybrid Renewable Energy Trainer			Page 08
	2011-2055	HRET - Hybrid Renewable Energy Trainer Modular Wind - Solar - Fuel Cell	
	Accessories		
		Module Stand (not mobile)	
		LCD Monitor; Monitor Holder	
	2000-2040	HRET - Hybrid Renewable Energy Trainer with Optional Components	
HyDrive			Page 09
	1000	Electric Vehicle Trainer	
Fuel Cell Trainer			Page 10
	693	Fuel Cell Trainer	
Nexa Integration System			Page 11
	1911	NEXA 1200	
Hybrid Energy Lab-System			Page 12
	793	Hybrid Energy Lab-System	
	Optional with integrated H2 generator		
Solar Hydrogen Trainer			Page 13
	810	Solar Trainer version (without hydrogen generator)	
	812	Solar Hydrogen Trainer 72nl/h optional extension of FCT and HEL	
	Accessories		
	821	PV Sensor Kit: Sensors for radiation, module and ambient temperature	
RENEWABLE ENERGY LABORATORY SOLUTIONS			
New Energy Lab			Page 14
	880	New Energy Lab, Optional with HG198nl/h	
ACCESSORIES			
Power-to-Gas Laboratory & Hydrogen Supply			Page 15
	1305 - 1306	HG30 Hydrogen Generator – 24-30 NI/h	
	1303 - 1304	HG72 Hydrogen Generator – 72 NI/h - 198nl/h	
	Accessories		
	1307	Optional remote control software	
Metal Hydride Storage Canisters			Page 15
	648	MHS200 - Metal hydride storage canisters with 200 NI	
	650	MHS800 - Metal hydride storage canisters with 800 NI	
Hydrogen Supply			
	631	200 bar H2 connection Kit	
	736	200 bar H2 connection Kit with safety valve	

New
version

New
version

New
version

New
version



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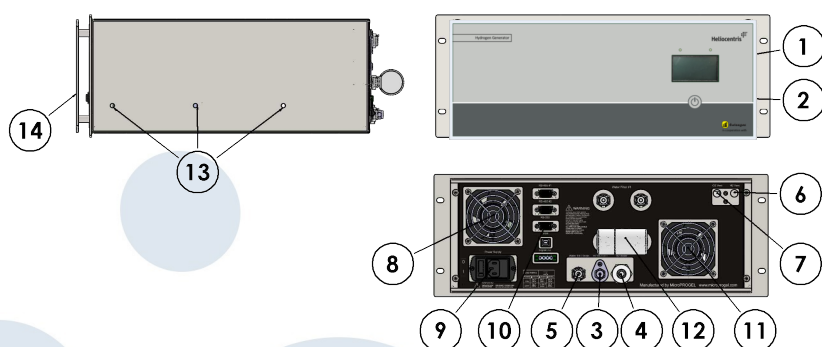
HG Rack Series



The HG Rack Series series generators use an electrolytic cell with polymeric membrane (PEM) to produce pure hydrogen. The innovative gas drying system is completely maintenance-free and allows continuous operation, 24 hours a day. The exclusive, electronically-controlled gas/liquid separator, automatic checking for internal leaks whenever starting the unit, and constant control of operating parameters guarantee maximum safety.

Up to 20 units can be connected in parallel.

The touch-screen LCD interface provides simple and user-friendly management of all functions on the unit.



- 1 Touch-screen LCD 128x64 pixel
- 2 START/STOP button
- 3 Hydrogen Outlet
- 4 Hydrogen purge
- 5 Water feed connector for filling the tank
- 6 Hydrogen vent
- 7 Oxygen vent
- 8 Cooling fan air outlet
- 9 Power connection and switch
- 10 I/O connectors: RS485 – RS232 – USB – Digital I/O
- 11 Cooling fan air intake
- 12 Water filter
- 13 Holes for sliding rails
- 14 Front handles

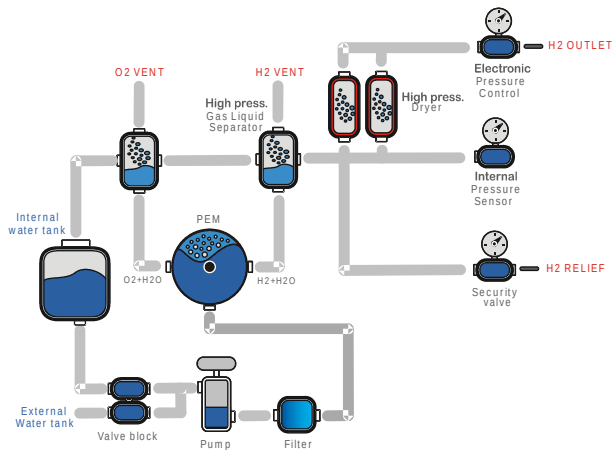
Main Applications

- Carrier gas for GC and GS-MS
- ICP-MS collision gas
- Flame ionization detector feed gas (FID)
- Refilling metal hydride tanks for use with fuel cells

Main Features

- **Available Flow-rates:**
up to 1200 cc/min
- **Outlet pressure:**
up to 12 bars
- **Hydrogen purity:**
>99.99999%
- **Drying system:**
Innovative maintenances-free system for continuous 24-hour operation
- **Internal water tank:**
1.1 litres, with electronic level control and “Autorefill” from external tank, included as standard
- **Dimensions:**
Standard 19" 4U/5U RACK (40 cm deep)
- **Weight:**
15 to 22 kg (depending on the model)
- **Certification:**
CE, ISO9001

Principle diagram



Hydrogen is produced from distilled water using a polymeric membrane (PEM). No acid or alkaline solutions are used. The drying stage requires no maintenance. A two-column drying system with automatic regeneration ensures the maximum grade of hydrogen purity.

Models	K00-1305 HG 24	K00-1306 HG 30	K00-1303 HG 72	K00-1304 HG 198
General data				
Electrolytic cell	PEM technology			
H2 purity	>99.99999%			
Outlet pressure	16 bars/232psi			
H2 flow rate cc/min (max)	400	500	1200	3300
Communication				
RS232	X	X	X	X
RS485	X	X	X	X
USB	X	X	X	X
LAN				
Software functions				
Parallel mode capability	X	X	X	X
Fill canister function	X	X	X	X
Water				
Quality	Deionized, ASTM II, <0.1uS			
Supply pressure (Min)	-0.2 bars (1.4 psi)			
Supply pressure (Max)	1 bar (14 psi)			
Supply flow-rate (min,max)	0.2 l/min, 1.5 l/min			
Internal tank capacity	1.1 l			
External tank capacity	5 or 10 l			
Electrical data				
Power supply connection type	IEC320-C13			Triple 4 pole connector
Power supply voltage	100-240Vac 50/60Hz			24V DC
Installed power (max)	280W	450W	560W	50 A
Fuse rating 5x20mm	4A 250VAC	6.3A 250VAC		ext. power supply
Dimensions	19" RACK 4U – 40cm deep			19" Rack 5U-40 cm deep
Net weight (water tank empty)	20 kg	22 kg	25 kg	29 kg
Connections				
Hydrogen outlet	1/8" compression fitting			
Water	Quick release push-in fitting			

Accessories:

Remote Software	K00-1307
Deionizer Water Filter HG30/HG72	L90-0010
Deionizer Water Filter HG198	L90-0011

Heliocentris

MHS – Metal Hydride Storage Canisters

Compact and safe hydrogen storage at low pressure

ACADEMIA OFFERING

The metal hydride storage canisters from Heliocentris allow safe and compact storage of relatively large amounts of hydrogen at low pressures.

Heliocentris' metal hydride storage canisters can store a multiple amount of hydrogen in comparison to a pressure storage at low pressure.

The metal hydride storage canisters are available in three different dimensions with storage capacities of 200 NI, 400 NI and 800 NI hydrogen at 25 bar filling pressure.

The MHS 200 and MHS 400 storages comply with the Art. 4.3 and the MHS 800 with the category 1 of the pressure equipment directive lowering the barriers of hydrogen usage in contrast to pressure storage devices.

Technology

The Heliocentris metal hydride storages are equipped with a low temperature AB2 metal alloy on a TiMg base:

- absorb the hydrogen in the alloy lattice after adsorption at the surface
- can store hydrogen at high volume- and low weight density (ideal for stationary application)
- has a low plateau pressures at about room temperature
- has a low thermal conductivity

The canister is designed as a passive surface cooled system. Heat ducting can be applied by the user with air ventilation or water cooling.

Temperature Handling

The nominal parameters of the canister are defined for a canister surface temperature of 20°C. The absorption/ desorption performance of the storage can be sensitively influenced by thermalizing the canister surface by:

- cooling the storage surface for absorption (filling) by water or air with 5 ... 20°C
- heating the storage surface for a continuously desorption by water or air with 20 ... 50°C
- usage of the ambient air with passive or active ventilation

Integration, Usage and Safety

An integrated quick coupling allows an easy and safe connection to an individual hydrogen source. The storage is equipped with a pressure and temperature relief valve to avoid dangerous conditions.



MHS 200 Art.-Nr. K00-0648
MHS 400 Art.-Nr. K00-0649
MHS 800 Art.-Nr. K00-0650

MHS 800 MHS 400 MHS 200

MHS – Metal Hydride Storage Canisters

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MHS 200
Art.-Nr.
K00-0648

MHS 400
Art.-Nr.
K00-0649

MHS 800
Art.-Nr.
K00-0650

MHS 800

MHS 400

MHS 400

MHS 800

MHS 200

Technical Data

Metal Hydride Storage Canister	MHS 200	MHS 400	MHS 800
PS (max. filling pressure level according to PED) ¹	25 bar (362.6 psi)		
Max. coupling pressure of quick coupling	17.2 bar (250 psi)		
TN (Nominal temperature) ²	20 °C		
Operation temperature	-5 ... 55 °C		
Thermalization temperature ³	5 ... 50 °C		
H2-Purity	Min. 5.0 (99.999 %)		
H2 Capacity (@ 20 °C and 25 bar)	200 NI	400 NI	800 NI
H2 Capacity (@ 20 °C and 15 bar) ⁴	150 NI	300 NI	600 NI
H2 Capacity (@ 20 °C with HG) ⁵	60 NI	120 NI	240 NI
Nominal discharge rate	1 NI/min	3 NI/min	4 NI/min
Total weight	2.2 kg	4.2 kg	7.3 kg
Overall length	310 mm	310 mm	470 mm
Diameter	70 mm	102 mm	102 mm
Bottle volume	0.5 l	1.0 l	2.0 l
Type of connectors	Parker 4M-Q4CY-SSP		

Parts of the system use hydrogen, a highly flammable gas. This requires compliance with local laws and safety regulations for transport, storage and operation. Read the operating manual carefully before setting up and operating the system.
We reserve the right to make changes without prior notice. © Heliocentris Academia International GmbH 2017

¹) PED – Pressure Equipment Directive

²) Nominal parameters are validated with 20°C water thermalization

³) allowed cooling or heating temperature with water or air

⁴) with Heliocentris H2 Connection Kit for compressed gas cylinders

⁵) with Heliocentris HG30/72/198 Hydrogen Generator