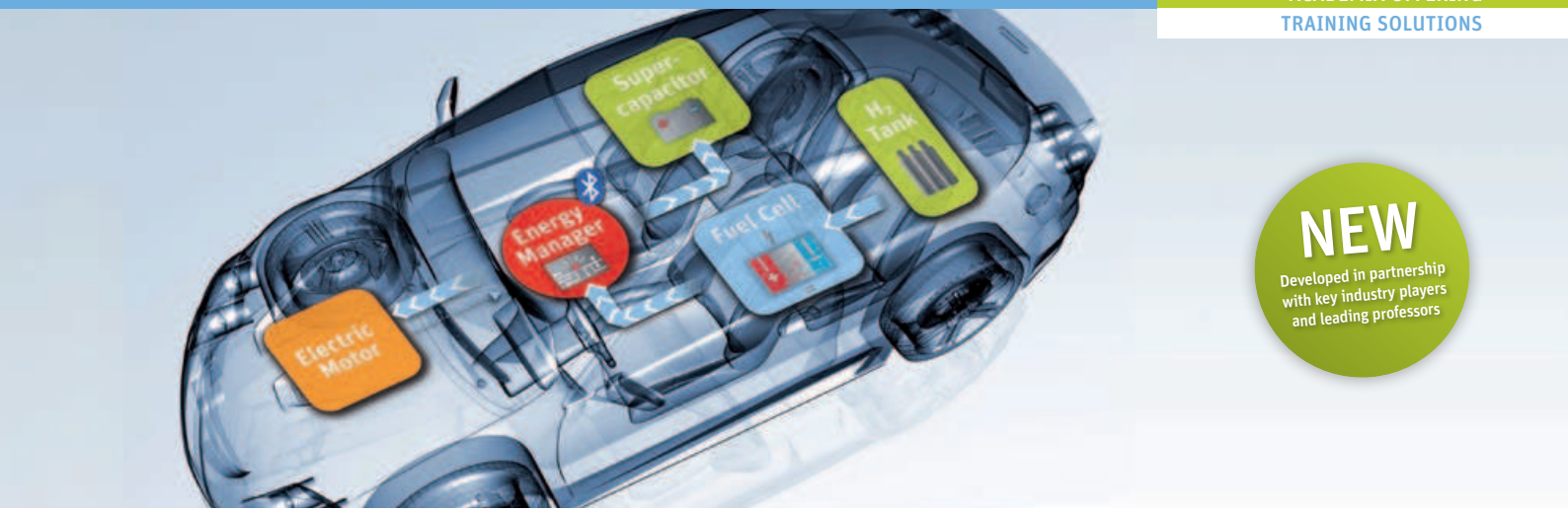
Heliocentris

HyDrive – Electric Vehicle Trainer

Experiment Set for Teaching Hydrogen Fuel Cell Technology in Electric Vehicles

ACADEMIA OFFERING
TRAINING SOLUTIONS

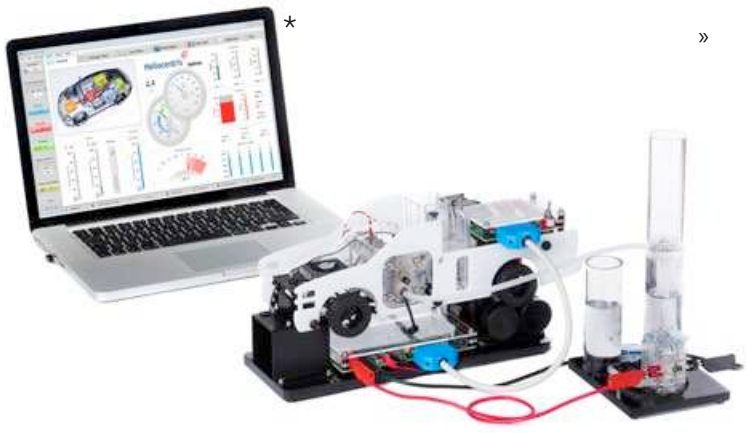


NEW
Developed in partnership with key industry players and leading professors

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.



The HyDrive 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 for wireless system control, parameter monitoring as well as real-time data plotting
- Extensive experiment guide with >15 experiments that facilitates autodidactical study and problem resolution

*Notebook not included

HyDrive – Electric Vehicle Trainer

Experiment Set for Teaching Fuel Cell Electric Vehicle Technology

The system supports education and training in:

- Automotive Mechatronics and Mechanical Engineering
- Commercial Vehicle Technology
- Electrical Drive Engineering
- Renewable Energy Technology
- Chemistry and Physics
- STEM & Technology Programs
- Pre-Engineering Programs

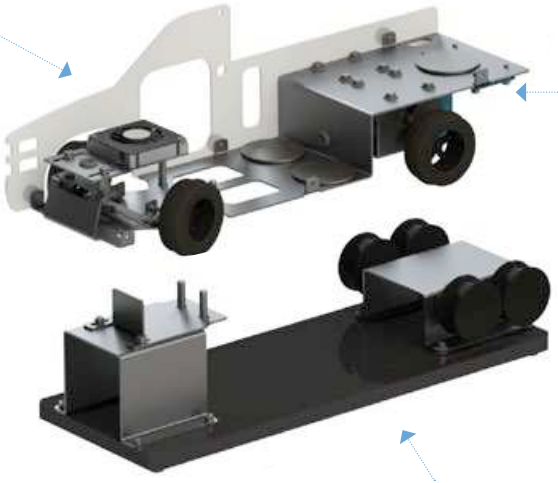
Hardware

Fuel Cell Stack
The 1 W 5-cell air-breathing fuel cell stack uses hydrogen and oxygen to generate electrical energy. The number of cells can be varied to experiment with different levels of output.

Gas Storage (2 pieces)
The two 30 cm^3 hydrogen storage canisters serve as a vehicle 'gas tank' and are being fueled by the H_2 filling station. The water absorber prevents the fuel cell from being flooded with distilled water.

Energy Management Board
This central control unit allows for wireless Bluetooth system control (e.g. for regulating the vehicle velocity, the electrolyzer, or the supercapacitor recuperation ratio) as well as data generation and analysis (e.g. individual cell voltages).

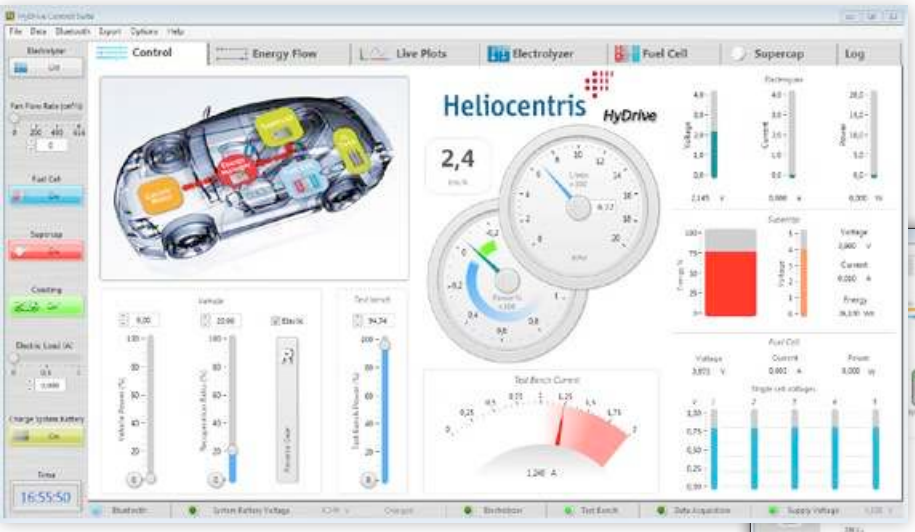
Fan
The fan increases the inflow of ambient oxygen into the fuel cell stack helping to regulate or boost its performance.



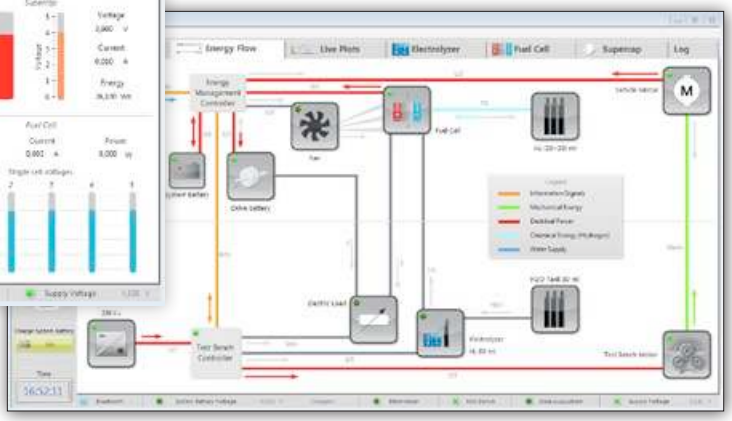
Supercapacitor
The supercapacitor serves to simulate the battery module in a hybrid vehicle. It can be loaded using the fuel cell stack or through recuperation by utilizing breaking energy. The supercapacitor allows for the hybridization of the system. This way the typical functionality of a hybrid battery vehicle and the role of the fuel cell as a "range extender" can be demonstrated.

Hydrogen Filling Station
The H_2 filling station consists of a 4 V double-membrane electrolyzer that utilizes electricity to decompose water into oxygen and hydrogen. The produced hydrogen is being stored inside the 80 cm^3 hydrogen canister and is being used to refuel the electric vehicle.

Vehicle Test Bench
In combination with the electrical load the test bench emulates the road (i.e. rolling resistance), allowing for the simulation of typical load profiles and individual drive cycles (e.g. inner city stop-and-go vs. highway).



System overview



Software showing the energy flow

Software

The LabVIEW based software facilitates system control and parameter 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.

Exemplary drive cycles that can be configured and visualized with the software are:

» Inner city stop & go
» Highway, uphill or downhill
» Fuel cell performance depending on oxygen supply
» The recuperation of breaking energy

Experiment Guide

The HyDrive experiment guide is used in conjunction with the educational software to convey theoretical knowledge and allow students to conduct practical experiments based on realistic scenarios and problems. The experiment guide provides extensive theoretical background information for resolving these specific problems.

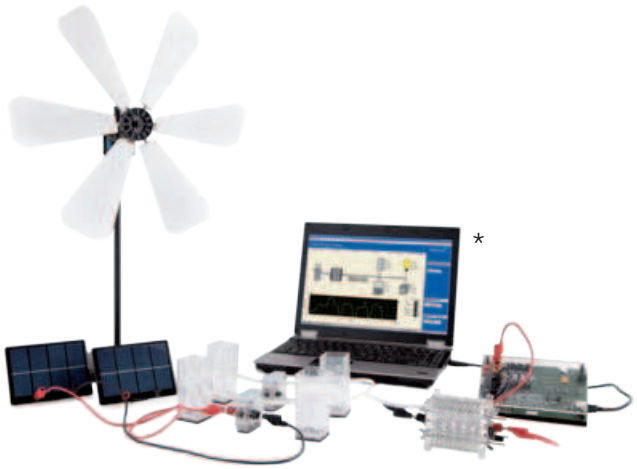
It covers the following theoretical and practical topics:

» The charge and discharge characteristics of a supercapacitor
» The characteristic curve of a fuel cell and its maximum power point
» The relationship between the fuel cell performance and air supply
» The basic equation of motion and the conversion of electrical to mechanical power
» The characteristic curve and energy efficiency of an electrolzer
» FCEVs in practice: the recuperation of breaking energy
» Constructing and testing a hybrid system

Clean Energy Trainer

Generate hydrogen for the HyDrive refueling process using the Clean Energy Trainer solar modules and wind generator. Experience and understand zero-emission mobility .

Clean Energy Trainer	**Art. no. 410***



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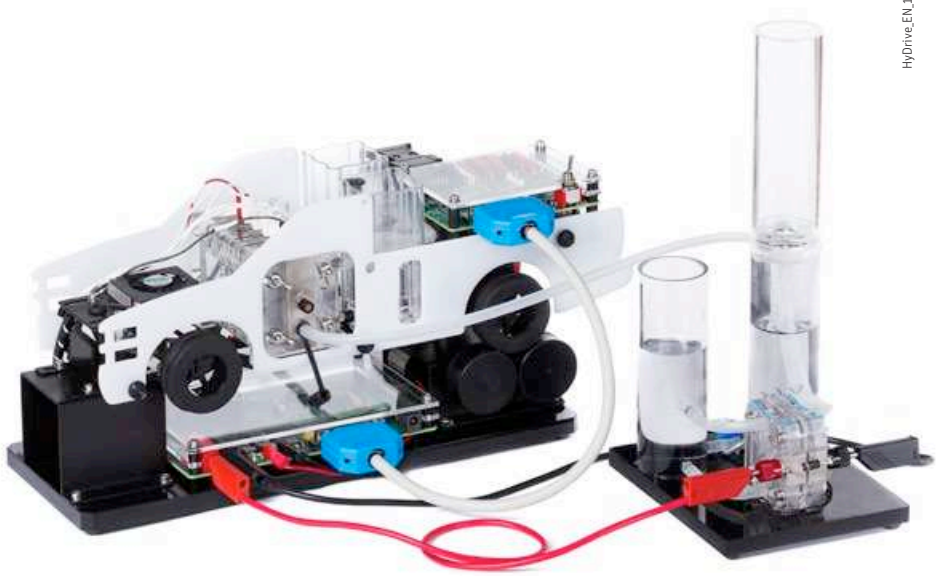

Technical Data

HyDrive	
Dimensions (W x H x D)	469 x 157 x 425 mm
Weight	approx. 10 kg
Permissible ambient operational temperature	+10 … +35 °C

Electrolyzer	
Dimensions (W x H x D)	42 x 56 x 57 mm
Weight	63 g
Voltage max.	4 V
Current max.	1919 mA
H_2 production	30 cm^3 / min

Take-apart Fuel Cell Stack	
Dimensions (W x H x D)	125 x 60 x 70 mm
Weight	288 g
Power per cell	0.2 W
Power (5 cells)	1 W
Voltage max.	1 – 4.5 V

Gas Storage	
Dimensions (W x H x D)	70 x 90 x 40 mm
Weight	48 g
Volume	60 cm^3

Test Bench	
Dimensions (W x H x D)	325 x 105 x 125 mm
Weight	Ca. 1 kg
E-Load current max.	Up to 1A
Power Supply electrolyzer voltage max.	Up to 5V

Supercapacitor	
Dimensions (W x H x D)	60 x 15 x 40 mm
Weight	Ca. 10 g
Capacity	3F

Energy Management Board	
Dimensions (W x H x D)	100 x 20 x 75 mm
Weight	Ca. 50 g
Wireless communication frequency	Bluetooth BLE 2.4 GHz

The output of the fuel cell and electrolyzer depends on various influencing factors and decreases over the life of the product. All information on the output applies at the time of delivery.
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.

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