

Hybrid Fuel Cell Application Trainer

– Automotive Training –

Hybrid Energy Lab System

With API
Possibility of HG integration

ACADEMIA OFFERING

Modern Transportation Technologies Require Advanced Engineering Education and Training

For environmental reasons and reacting to the finiteness nature of fossil fuels, the automotive industry is going through yet another shift that includes the introduction of electric drive vehicles. This change is driving the need for a workforce with new technical and engineering capabilities able to handle the complex demands.

Students will need to have advanced skills for electric drive vehicles, this includes Battery Electric Vehicles (BEV), Hybrid Electric Vehicles (HEV), Plug-In Hybrid Electric Vehicles (PHEV), Extended Range Electric Vehicles (EREV), Fuel Cell Electric Vehicles (FCEV), and Fuel Cell Hybrid Electric Vehicles (FCHEV).

Technical training and engineering schools, colleges and universities are required to modify their programmes to bring these new technologies into the lecture halls and to their students. Heliocentris offers hands-on training systems that are designed to help students acquire the necessary knowledge, competences and skills to work with existing and future electric drive systems.



Hybrid Fuel Cell Application Trainer – the All-rounder Training System

The Hybrid Fuel Cell Application Trainer is ideal for the modulation of various real-world energy applications, focusing on design and hybridization aspects of a battery hybrid fuel cell system. The trainer can be used to simulate:

- » Hybrid Electric Vehicle Power Supply
- » Uninterruptible Power Supply (UPS)
- » Autonomous Power Supply
- » Portable Power Supply

Automotive Training - Experiments

The Hybrid Fuel Cell Application Trainer is designed with the same configuration as a typical Fuel Cell Hybrid Electric Vehicle. It features a Nexa® fuel cell module, hydrogen storage tanks, a lead battery, power electronics and a control software.

However, fuel cells can be integrated in vehicles in different ways, and the Nexa® Training System makes it possible to explore three different scenarios:

- » Fuel cell system is directly connected to the motor
- » Fuel cell system recharges the battery bank (main source of energy) for range extension
- » fuel cell runs when the motor needs more power or the battery bank is depleted

The different components can be examined individually or combined which is ideal to study various topics of Hybrid (Fuel Cell) Electric Vehicles:

- » Driving cycles, driving range and load profiles
- » Hybridization: fuel cell and battery technology
- » Dimensioning of hydrogen and battery capacity
- » Refilling behavior
- » Fuel cell as range extender
- » Energy conversion, consumption and system efficiency
- » Serial and parallel hybrid drive modes
- » Battery tests: (dis-) charging characteristics, battery capacity
- » Hydrogen storage: weight - volume tests
- » Simulation: design an optimized hybrid fuel cell car
- » Fuel Cell: thermal management, efficiency, losses, e.g.

The training system can supply a 1200 W load (e.g. an electric motor). Also, the 1200 W Nexa® fuel cell can also be dismantled from the training system and instead be used for fuel cell hybrid automotive application projects.

Technical Data

Nexa® Training System - Hybrid energy Lab System		Battery Module	
Dimensions (W x H x D)	520 x 1330 x 600 mm	Battery set 1	low capacity 24 V (2 x 12 V), 1.9 Ah
Weight approx.	200 kg	Battery set 2	high capacity 24 V (2 x 12 V), 18 Ah
Permissible environment temperature during operation	+ 15 ... +40°C	Safety elements	fuse, 2 x temperature sensors
Connection standards	DIN, CGA, BS	Power Electronics Module	
Mains Connection	230 V (50 Hz), 115 V (60 Hz)	DC Converter with Integrated Load Regulator	
Fuel Cell Module		Rated output voltage	24 V DC
Fuel Cell System		Output voltage range	0 ... 32 V DC
Rated output as delivered	1200 W	Rated output current	55 A DC
Rated current	65 A DC	Max. output power	1500 W
Operating voltage	20 ... 35 V DC	Max. inlet voltage range	12 ... 45 V DC
Maximum hydrogen consumption at rated output	15 sl/min	Max. inlet voltage range	45 V DC
Hydrogen purity for operation	4.0 (99,99 %)	Efficiency	> 96%
Permissible H ₂ inlet pressure	1 ... 14 bar	Inverter	
H ₂ Flow Meter		Continuous output power	1500 W
Measuring range	0,6 ... 30sl/min	Inlet voltage	24 V
Measuring accuracy	± 1.5 % from the end value	Output voltage	110/230 V (60/50 Hz)
H ₂ Sensor		Output signal form pure sine	pure sine (THD < 3%)
Sensor standard range	0.00 ... 4.00 Vol. %	Efficiency	8789 % (110/230 V)
PC and Software		H ₂ Storage Module	
19" all-in-one PC, keyboard, mouse		Hydrogen inlet	loading pressure max. 14 bar
Windows 7 and software pre-installed		Hydrogen output	0 .. 14 bar, fill-level dependent
		Hydrogen manometer	0 ... 25 bar
Electronic Load		Metal Hydride Canisters	
Max. continuous power output	1200 W	Storage capacity (at charge pressure of 17 bar)	max. 3 x 760 sl hydrogen (2280 sl hydrogen)
DC load voltage	0 ... 80 V DC	Output (continuous, at room temperature)	max. 16.5 sl/min
DC load current	0 ... 85 A DC	Loading pressure	10 ... 17 bar
Load resistance	0.08 ... 30 Ω	Safety elements	3 x temperature sensors, pressure relief valve, hydrogen safety switch, manometer
Mains connection	230 V (50 Hz), 115 V (60 Hz)		
Communication	USB		

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