Heliocentris

Hybrid Fuel Cell Application Trainer – Automotive Training –

Hybrid Energy Lab System

With OPC UA
Possibility of HG integration

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 programms 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-word 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
» Uninterruptable 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 Hybrid Energy Lab 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

Hybrid Energy Lab System	
Dimensions (W x H x D)	520 x 1330 x 600 mm
Weight approx.	200 kg
Permissible environment temperature during operation	+ 15 … +40°C
Connection standards	DIN, CGA, BS
Mains Connection	230 V (50 Hz), 115 V (60 Hz)
Fuel Cell Module	
Fuel Cell System	
Rated output as delivered	1200 W
Rated current	65 A DC
Operating voltage	20 … 35 V DC
Maximum hydrogen consumption at rated output	15 sl/min
Hydrogen purity for operation	4.0 (99,99 %)
Permissible H_2 inlet pressure	1 … 14 bar
H_2 Flow Meter	
Measuring range	0,6 … 30sl/min
Measuring accuracy	± 1.5 % from the end value
H_2 Sensor	
Sensor standard range	0.00 … 4.00 Vol. %
PC and Software	
19'' all-in-one PC, keyboard, mouse	
Windows 7 and software pre-installed	
Electronic Load	
Max. continous power output	1200 W
DC load voltage	0 … 80 V DC
DC load current	0 … 85 A DC
Load resistance	0.08 ... 30 Ω
Mains connection	230 V (50 Hz), 115 V (60 Hz)
Communication	USB

Battery Module	
Battery set 1	low capacity 24 V (2 x 12 V), 1.9 Ah
Battery set 2	high capacity 24 V (2 x 12 V), 18 Ah
Safety elements	fuse, 2 x temperature sensors
Power Electronics Module	
DC Converter with Integrated Load Regulator	
Rated output voltage	24 V DC
Output voltage range	0 … 32 V DC
Rated output current	55 A DC
Max. output power	1500 W
Max. inlet voltage range	12 … 45 V DC
Max. inlet voltage range	45 V DC
Efficiency	> 96%
Inverter	
Continous output power	1500 W
Inlet voltage	24 V
Output voltage	110/230 V (60/50 Hz)
Output signal form pure sine	pure sine (THD < 3%)
Efficiency	8789 % (110/230 V)
H_2 Storage Module	
Hydrogen inlet	loading pressure max. 14 bar
Hydrogen output	0 .. 14 bar, fill-level dependent
Hydrogen manometer	0 … 25 bar
Metal Hydride Canisters	
Storage capacity (at charge pressure of 17 bar)	max. 3 x 760 sl hydrogen (2280 sl hydrogen)
Output (continous, at room temperature)	max. 16.5 sl/min
Loading pressure	10 … 17 bar
Safety elements	3 x temperature sensors, pressure relief valve, hydrogen safety switch, manometer

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