Discover the MOTHYS system, consisting of a PEM fuel cell with H2Sys and ERM

Educational system and demonstrator focusing on the use of hydrogen as a carbon-free energy carrier

Hydrogen consumption: Fuel cell

Mothys hybrid system

H2SYS offers its MOTHYS system dedicated to learning about hydrogen energy systems for hybrid PAC/battery units.

The system consists of a PEM fuel cell with CAN communication and a hybrid/battery converter module.

The Mothys package includes the following components

- An AIRCELL 500 fuel cell – air-cooled open cathode fuel cell with a power output of 500W, unregulated DC output, Canbus communication, integrated hydrogen sensor, flow meter, and tablet-based HMI.
- A battery with BMS – NMC technology according to intended use with BMS and electrical protection included
- An Arduino Mega control board
- A 24 or 48 Vdc DC/DC boost converter with CAN communication

Technical summary

Données techniques

PILE A COMBUSTIBLE

Modèle - puissance	AIRCELL 500 / Sur demande ACS 1000 Puissance nominale 500 W
Technologie	PEM
Pression hydrogène	6 - 10 bar
Consommation hydrogène (Nl/min)	6 Nl/min (débitmètre inclu)
Courant / Tension	0-50A (max 65 A) / 12-18 Vdc non régulé
Sécurité	Capteur H2 Arrêt d'urgence par commande 24V

BATTERIE/CONVERTISSEUR

Batterie	Technologie Lithium (NMC) – BMS Intégré
Capacité de tension	50 Vdc / 22 Ah
Courant max	80 A (2s.)
Courant continu	53 A
Recharge du courant	4 à 8 A
Convertisseur	Convertisseur Boost - Tension régulée Limite de courant adaptable (0 - 55 A)
Sécurité	Protection électrique

COMMUNICATION

Pile à combustible	Communication Canbus intégrée Protocole Canbus 2.0 A
Batterie	Protocole Canbus Bluetooth
Mothys	Connecteur USB-B mâle RJ45

Hydrogen consumption: Fuel cell

Mothys hybrid system

Mothys includes a touchscreen HMI that allows students to manually control the system and define the hybridization strategy associated with the system.

The system can operate in four different modes:

- **Automatic** mode:

Automatic mode allows you to run a cycle pre-recorded in the MOTHYS system. The user can instantly power their load thanks to battery operation. When the fuel cell is started, the battery SOC will be regulated.

- **Manual** mode:

Manual mode allows the user to control each element of the MOTHYS system. They can act on the components individually in order to understand the purpose of each one before operating the system in hybrid mode.

- **Customizable** mode:

Customizable mode allows users to program their own operating cycle using a programmable Arduino via Simulink. Customizable mode allows different control strategies to be implemented by applying different energy laws.

*(ERM cannot provide support for this mode)*

- **Recharge** mode:

If the user wishes to recharge the MOTHYS system battery, recharge mode isolates the battery from the user output and starts the fuel cell system to perform the recharge. If the system supervisor detects that the battery charge level is too low, recharge mode will be the only operating mode available until a certain battery SOC value is reached.
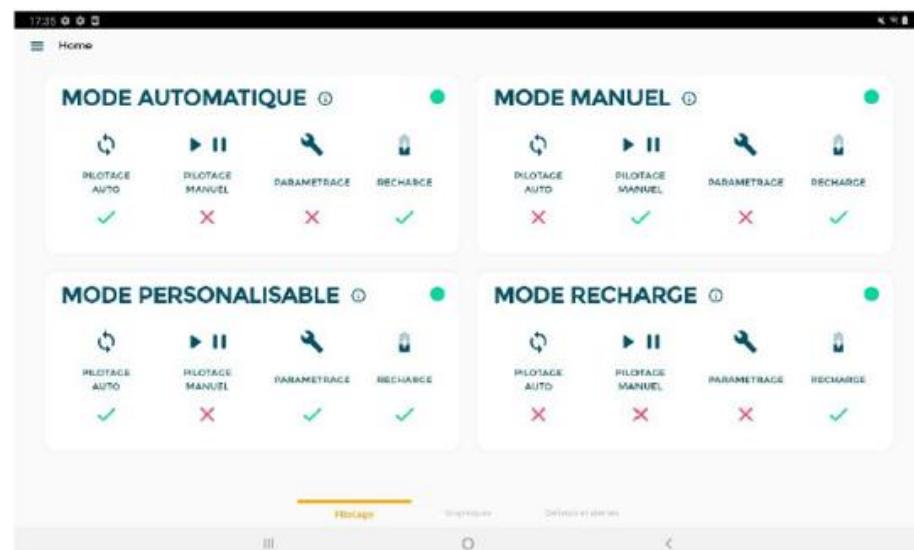
Mothys hybrid system
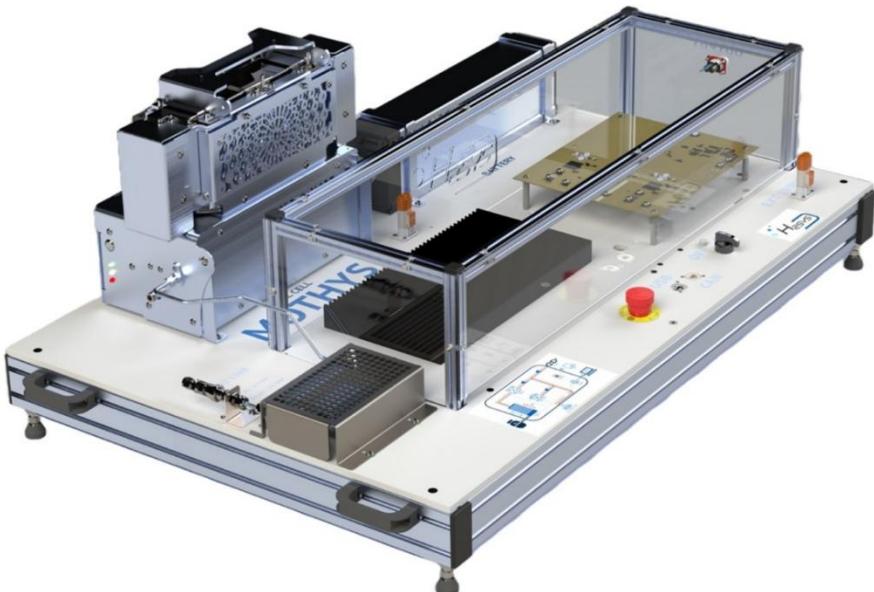
Mothys -
Schematic
of principle

Complete
Mothys
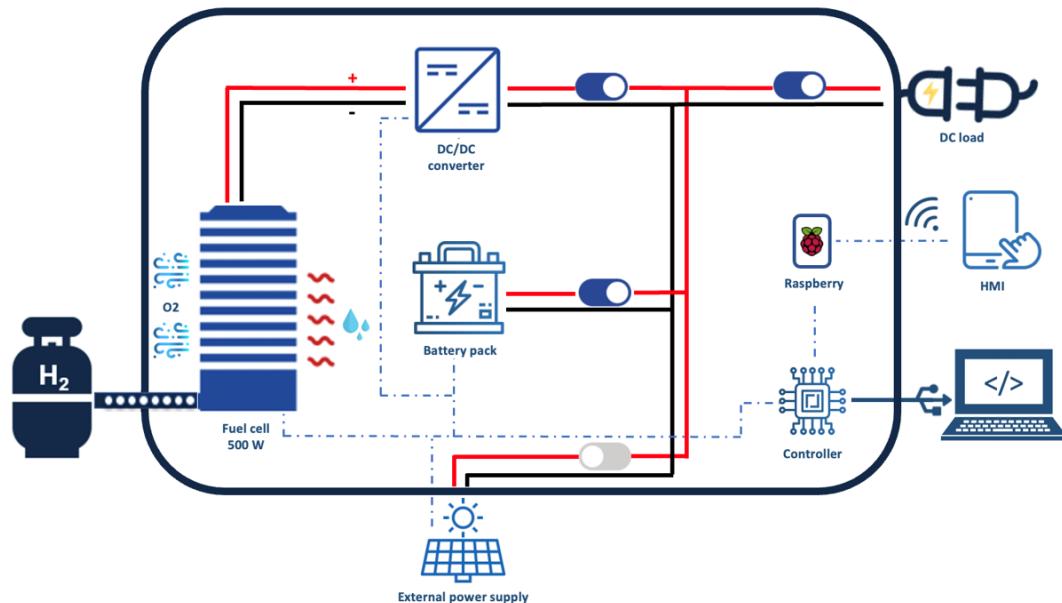
ACS 500 fuel cell
Power 500 W

Hydrogen consumption: Fuel cell

Mothys hybrid system

Manual mode:
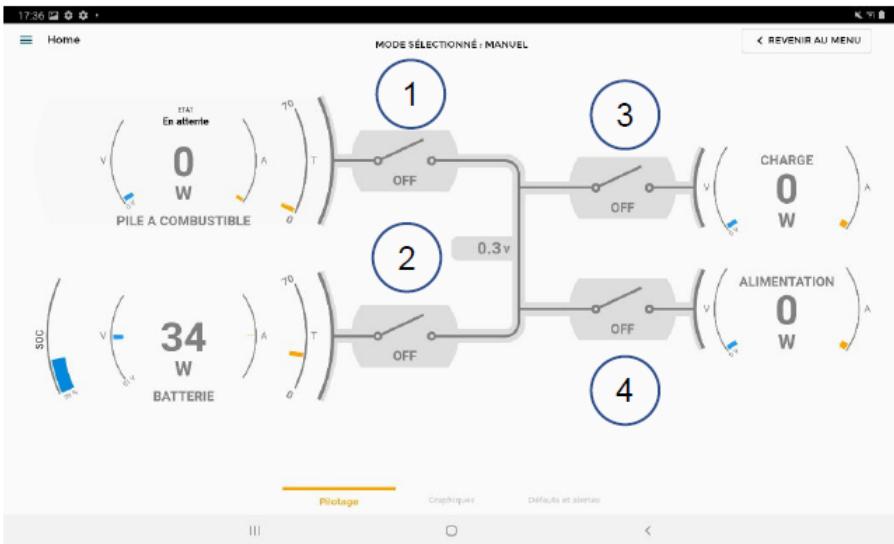
Number	Action
1	Starts/stops the fuel cell and associated contactor
2	Opens/Closes the switch associated with the battery
3	Opens/Closes the switch associated with the output load
4	Opens/closes the contactor associated with the external source

The menu for controlling the various system components is the same for all operating modes. It contains various information depending on the components concerned.

Fuel cell:
o Voltage
o Current
o Temperature
o Operating status
o Hydrogen flow rate

Battery:
o Voltage
o Current
o Temperature
o State of charge

Charge:
o Current
o Voltage

External power source:
o Current
o Voltage

Consumption (Mothys fuel cell)

- Checking the battery charge status against initial specifications
- Discovering the Aircell battery
- Discovering the Mothys system
- Optional PI29 activities (motorized wheel)

Documentation provided

All of the following documents are provided in paper form in French in one (1) copy and in digital form via a link:

- Fuel cell system maintenance document
- PAC system operating manual and presentation document
- MOTHYS system operating manual and presentation document
- Practical work and educational content

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