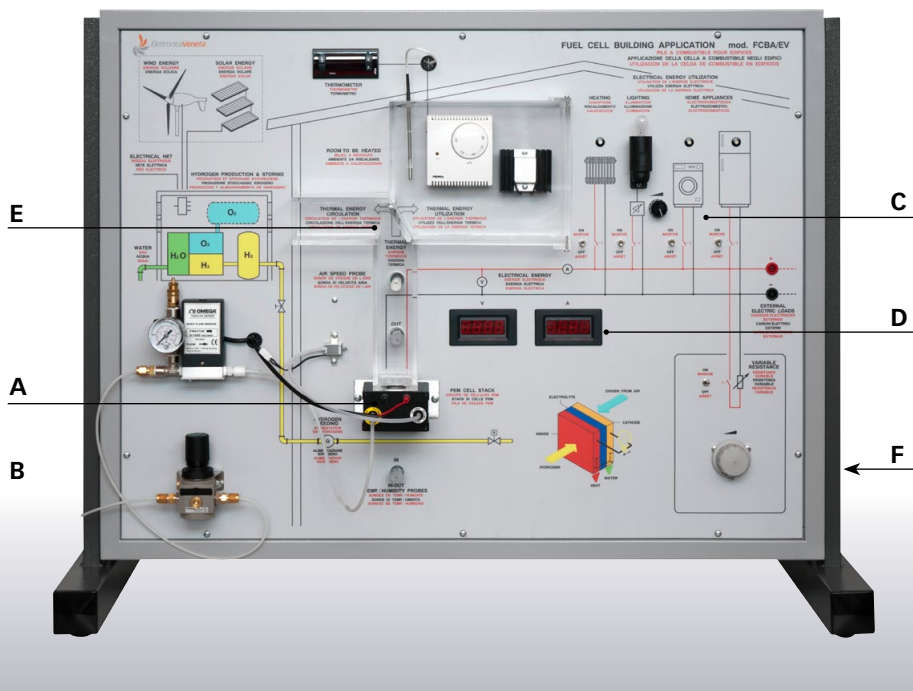


FUEL CELL TRAINER

Mod. FCBE/EV

Mod. FCBA/EV (computerized version)



RENEWABLE ENERGIES

28A-E-FC-FCBE-FCBA-1 www.elettronicaveneta.com

INTRODUCTION

Energy saving and environmental pollution reduction are crucial global issues. Using Hydrogen as alternative source to fossil fuels can address both issues, especially if it is produced with the help of renewable energies.

Considering the above, this system enables experimental investigation of the electrochemical energy conversion taking place in a fuel cell stack fed by hydrogen and oxygen (present in atmospheric air). The equipment is manufactured using real components available on the market.

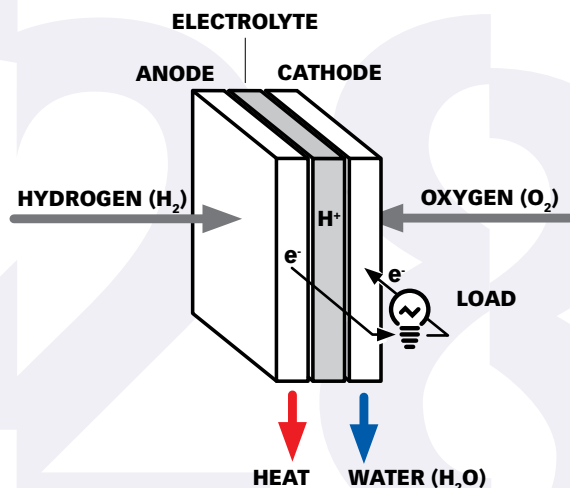
DESCRIPTION

The system consists of:

- A) Fuel cell stack
- B) Hydrogen feeding line
- C) Switchable electric loads
- D) Instrumentation
- E) Transparent room for simulation of domestic heating (on request for mod. FCBE/EV)
- F) Data acquisition board with USB interface for PC connection (mod. FCBA/EV only)

Relevant features:

- The fuel cell stack is PEM type and consists of 13 cells connected in series.
- The room air feeding the stack carries the oxygen and cools the stack at the same time.
- To operate, the fuel cell stack must be fed with hydrogen supplied by mod. HG-300 and H2-300 (not included - refer to the end of this data sheet).
- The fuel cell stack can be connected to constant or variable electric loads supplied with the equipment. It can also be connected to the optional DC motor (refer to mod. DCM/EV at the end of this data sheet).
- The stack cooling air can be conveyed to a reduced-size transparent room to increase the temperature of the room itself. This feature is available on request for mod. FCBE/EV.

Operating principle:

The hydrogen coming from the hydrogen generator or the cylinder crosses the membranes of the fuel cell stack and combines with the oxygen of the air forming water. This process produces, on the one hand, electricity and, on the other hand, heat. The electricity is used to power an electric load while the heat is properly conveyed to heat a reduced-size room; as soon as the room setpoint is reached, the room thermostat switches the position of a damper which allows to release this heat (no longer needed) into the atmosphere.

TRAINING PROGRAM:

- Electrochemical power conversion in a fuel cell
- Characteristics and application of fuel cells
- Measurement of the fuel cell stack output parameters in different conditions of load
- Drawing the characteristic curves
- Fuel cell stack efficiency calculation
- Calculation of the heating power produces by the fuel cell stack (in case of model FCBE/EV, two optional instruments are required, refer to mod.s THRN and THAM at the end of this data sheet)
- Study of energy flows and related measurement devices

TECHNICAL SPECIFICATIONS:

- Table top steel structure with a comprehensive colored diagram of the system
- Fuel cell stack including controller:
 - fuel cell type: PEM
 - cells number: 13
 - rated power: 20W
 - performance: 7,8V @ 2,6A
 - humidification: self-humidified
 - cooling: air (plug-in fan)
 - hydrogen flow rate at maximum power: 0,28 l/min
 - stack efficiency at rated power: 40%

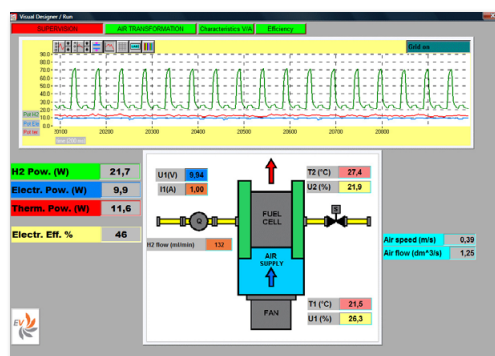
- Hydrogen feeding and discharge to the atmosphere lines with:
 - pressure regulator
 - dial pressure gauge, range: 0 ÷ 1 bar
 - safety valve
 - variable area flow meter, range: 50 ÷ 600 cm³/min (mod. FCBE/EV only)
 - thermal mass flow meter, range: 20 ÷ 1000 ml/min (mod. FCBA/EV only) for measuring and transmitting to the data acquisition board the flow rate of hydrogen feeding the fuel cell stack
 - purge solenoid valve
- Air stream plexiglass conveyor at the stack outlet
- Plexiglass reduced-size room with door (for mod. FCBE/EV upon request) including:
 - room thermostat
 - motorized damper
 - air dissipator
- Electric instrumentation
 - DC digital voltmeter for the stack output voltage
 - DC digital ammeter for the stack output current
 - digital thermometer with Pt100 probe for measuring the temperature inside the reduced-size room (upon request for mod. FCBE/EV)
- Switchable DC loads:
 - toroidal rheostat with adjustment knob for drawing the stack characteristic curves
 - variable intensity lamp
 - 3 fixed resistors with indicator LEDs for simulating loads appliances
- Ø 4 mm safety holes for connection to the optional DC motor (refer to mod. DCM/EV at the end of this data sheet)

Thermo-hygrometric sensors (mod. FCBA/EV only) for measuring and transmitting to the data acquisition board air temperature and relative humidity at stack inlet and outlet, range: 0÷50°C (temperature) and 0÷100% (relative humidity)

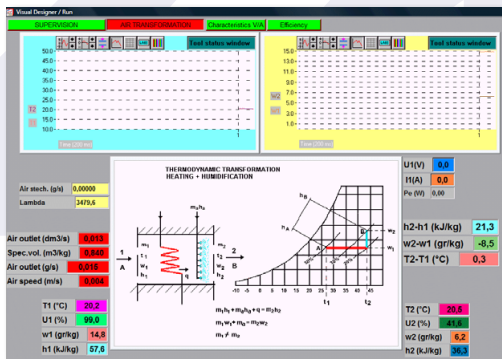
Air speed sensor (mod. FCBA/EV only) for measuring and transmitting to the data acquisition board the air speed at the stack outlet, range: 0÷5 m/s

PC data acquisition (mod. FCBA/EV only)

- The unit includes a data acquisition board with USB interface for connection to PC.
- The unit is supplied with a specific software for monitoring the different parameters of the system.



- Parameters displayed:
 - Voltage and current generated by the stack and powering the loads
 - Flow rate of hydrogen feeding the stack
 - Temperature and relative humidity of air at stack inlet and outlet
 - Air speed at stack outlet



- The software enables to:
 - Calculate the energy conversion efficiency
 - Visualize the trend of power entering the stack (related to the hydrogen flow rate), stack electric power output, thermal power released by the stack
 - Visualize the air enthalpy and hygrometric rate at stack inlet and outlet
 - Visualize the trend of air temperature and relative humidity at stack inlet and outlet
 - Draw the fuel cell stack characteristic curves output voltage vs output current and efficiency vs output current to find out the point of stack maximum performance
 - Save the exercises data for future analysis or project work

Power supply: 230 Vac 50 Hz single-phase - 60 VA
(Other voltage and frequency on request)

Dimensions: 92 x 46 x 72 cm

Weight: 37 kg

INDISPENSABLE

PERSONAL COMPUTER
- NOT INCLUDED -
(mod. FCBA/EV only)



PEM ELECTROLYZER
Mod. HG-300 (NOT INCLUDED)
To feed the storage tank; capacity: 300 ml/min

METAL HYDRIDE STORAGE TANK
Mod. H2-300 (NOT INCLUDED)
To feed the fuel cell; capacity: 300 l



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL

PORTABLE THERMOHYGROMETER
Mod. THHY (mod. FCBE/EV only)
To measure air temperature and relative humidity at fuel cell stack inlet and outlet



PORTABLE ANEMOMETER
Mod. THAM (mod. FCBE/EV only)
To measure the air speed at fuel cell stack outlet

DIRECT CURRENT MOTOR Mod. DCM/EV
Direct current variable-speed motor, for studying the application of fuel cells in the field of road transport

