

GFC-6100

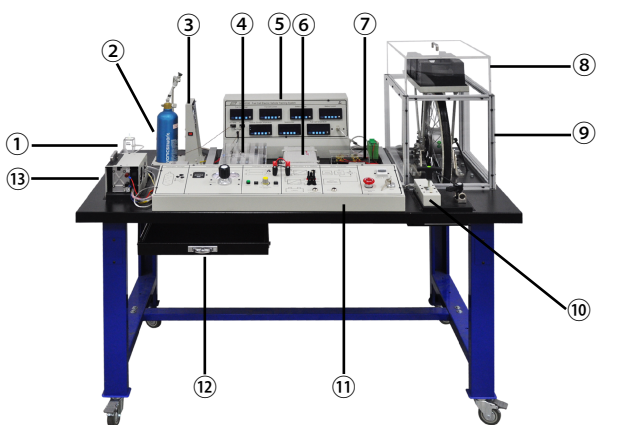
Fuel Cell Electric Vehicle Training System



A Fuel Cell Electric Vehicle (FCEV) is a hydrogen vehicle which uses a hydrogen fuel cell to produce electricity to power its on-board electric motor. Using fuel cells in vehicles provides an effective solution for energy resource and environmental pollution. In the progress of fuel cell technology, the importance of the topics such as how to use fuel cell in an electric vehicle system and how to integrate fuel cell control with other subsystems has been enhanced. To solve these problems, the GFC-6100 Fuel Cell Electric Vehicle Training System is designed to demonstrate the application of fuel cells to electric vehicles, including the FCEV mechanism, fuel cell system, hydrogen supply system, and motor controller.

► Features

- System experiment can still be operated without connecting electric supply. More convenient for demonstration.
- The power source of storage battery can be from electric supply or fuel cell.
- System panel's Data output is able to connect with PC through software.
- Dual power source electric vehicle system :
Two combined power sources, hydrogen fuel cell and lithium-ion battery, are switchable to power the FCEV.
- Adjustable power output :
With the switching between the two power sources, the FCEV can run on a separate lithium-ion battery and hydrogen fuel cell, or lithium-ion battery and hydrogen fuel cell series connection.
- High energy efficiency and long driving range :
With complementary discharging characteristics of hydrogen fuel cell and lithium-ion battery, the efficiency of entire system is enhanced.
- Real-time vehicle information display :
While the FCEV running, the information of voltage, current, speed and temperature will be displayed on the instrument panel.
- Learning hydrogen fuel cell :
The training system also provides the learning experience in hydrogen fuel cells, hydrogen supply, storage and safety.



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| ① Water collection and Hydrogen releasing tank | ⑧ Load Unit |
| ② Hydrogen storage | ⑨ BLDC MOTOR |
| ③ Temperature cool down and heat up fan | ⑩ Acceleration and friction controller |
| ④ DC to DC Converter | ⑪ System Control Panel |
| ⑤ System panel | ⑫ Storage drawers |
| ⑥ Storage battery (24V/10Ah) | ⑬ Fuel Cell and Controller |
| ⑦ Motor controller | |

► Specifications

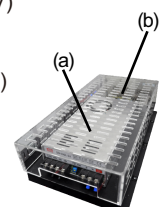
1. Water collection and hydrogen releasing tank
Capacity : 50ml

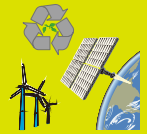


2. hydrogen storage, temperature cool down and heat up fan (optional)
 - a. Thermocouples : J Type (-210~760°C)
 - b. Fan (can set up the activation conditions from software) ×2
Input Voltage : 24 VDC



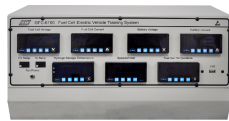
3. DC to DC Converter
 - a. A DC-DC Converter for fuel cell (DC to DC Converter 1)
Input voltage : 19~72 VDC(with wide voltage input)
Output voltage : 24V (adjustable 23~30V)
 - b. Peripheral BOT system voltage
Input voltage : 19~36 VDC
Output voltage : 12V (adjustable 11~16V)





4. System Panel

- a. Fuel cell voltage meter
 - (1) Input : DC 0~50V
 - (2) Display : DC 0~50V
 - (3) Communication : RS-485
- b. Fuel cell current meter
 - (1) Input : Shunt 10A/50mV
 - (2) Display : DC 0~10A
 - (3) Communication : RS-485
- c. Battery voltage meter
 - (1) Input : DC 0~50V
 - (2) Display : DC 0~50V
 - (3) Communication : RS-485
- d. Battery current meter
 - (1) Input : Shunt 15A/50mV
 - (2) Display : DC 0~15A
 - (3) Communication : RS-485
- e. Hydrogen storage temperature meter
 - (1) Input : J-Type-210~760oC
 - (2) Display : -210~760oC
 - (3) Setting : Hi-Lo
 - (4) Communication : RS-485
- f. Fuel cell temperature meter
 - (1) Input : J-Type-210~760oC
 - (2) Display : -210~760oC
 - (3) Communication : RS-485
- g. Speedometer meter
 - (1) Input : Open collect EXT : DC 12V
 - (2) Display : 0~19999 RPM
 - (3) Communication : RS-485
- h. FC. temp. socket
- i. H2 temp. socket
- j. Fan power socket
- k. USB port



5. Storage battery

- a. Battery type : Lithium-ion
- b. Battery configuration : 7S1P
- c. Nominal voltage : 25.9V
- d. Typical capacity : 10Ah
- e. Maximum charging voltage : 29.4V
- f. Discharge cut-off voltage : 19.6V
- g. Maximum discharging current : 20A
- h. Standard charge : 2A
- i. Maximum charging current : 5A
- j. Operating temperature :
 - 0°C~45°C (Charging)
 - 10°C~50°C (Discharging)



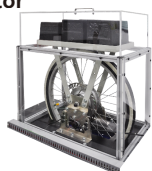
6. Motor controller

- a. Input voltage : 24 VDC
- b. Motor hall sensor
- c. Speed modification



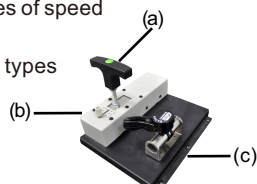
7. Load & drive motor : Brushless DC motor

- a. Rated power : 200W
- b. Wheel : 20"
- c. Brake : Disc brak



8. Acceleration and friction controller

- a. Constant speed controller : 3 Types of speed
- b. Accelerator
- c. Friction controller : Can emulate 6 types of friction



9. System panel (Divided into 5 functional blocks)

- a. Hydrogen storage (Optional)
- b. Hydrogen regulator
 - (1) Inlet pressure gauge : 0~400 psi
 - (2) Outlet pressure gauge : 0~30 psi
- c. Hydrogen fuel cell
 - (1) Short circuit unit
 - (2) Fan tachometer control
- d. DC to DC Converter & Li battery
- e. Motor controller



10. Emergency switch

11. Battery breaker

12. PEMFC

- a. Performance
 - Rated power : 200W
 - Rated voltage : 28V
 - Rated current : 7.2A
 - Voltage range : 24~46V
- b. Fuel
 - Pure hydrogen : > 99.95%
 - Pressure : 0.45~0.55 Bar
 - Hydrogen consumption : 2.8 L/min
 - Oxidant/coolant : Air
- c. Operating environment
 - Ambient temperature : -5°C~40°C
 - Ambient humidity : 20%~95%
 - Fuel cell stack operating temperature: -10°C~60°C

► List of Experiments

1. Introduction to fuel cell electric vehicle (FCEV)
2. Chapter 1. GFC-6100 Introduction
3. Chapter 2. Electric vehicle power battery
4. Chapter 3. Driving system of electric vehicle
5. Chapter 4. Electric battery vehicle
6. Chapter 5. Fuel cell system of electric vehicle
7. Chapter 6. The power performance index of electric battery vehicle
8. Chapter 7. Activation of fuel cell battery
9. Chapter 8. The relationship between short circuit unit (SCU) and fuel cell battery's voltage-current characteristics
10. Chapter 9. The effect of operating pressure on fuel cell battery
11. Chapter 10. Direct fuel cell vehicle
12. Chapter 11. Series hybrid electric fuel cell vehicle

► Accessories

1. Experiments manual
2. Connection leads and plugs : 1set
3. CD : software
4. USB Cable
5. H2 Regulator

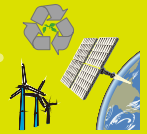
It is a pressure regulator between high-pressure Hydrogen cylinder and GFC-6100.

- (1) Inlet connector : There are 4 types of cylinder connections, users need to confirm before purchasing.

Gas Connection Assignment Table				
	CGA DISS	CGA	JIS	DIN
Hydrogen	724	350	22-L	DIN1

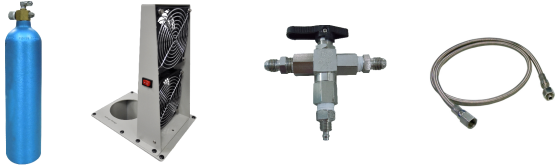
- (2) Inlet pressure gauge : 0~400 bar
- (3) Outlet pressure gauge : 0~16 bar





► **Optional**

1. Hydrogen storage with temperature cool down and heat up fan
 - a. Hydrogen capacity : 860 L \pm 5% (durability is around 5 hours)
 - b. Raw hydrogen purity : \geq 99.99%
 - c. Charging pressure : 1~1.7 MPa
 - d. Discharging pressure : $>$ 0 and \leq 1.7 MPa
 - e. Hydrogen purity during discharging : \geq 99.999%
 - f. Discharging flow rate : \leq 6 L/min
 - g. Thermocouples J Type x1
 - h. Split Type 3-way ball valve



2. 3311F DC Electronic load with 3302F mainframe
 - a. Voltage control range : 0V~60V
 - b. Current control range : 0A~60A
 - c. Output power : 300W
 - d. 5 digital V/A/W meter
 - e. Power ON status value can be set
 - f. High-speed measurement and communication transmission
 - g. Flexible CC, CR, CV, CP, dynamic and short operation modes
 - h. V/A/W values can be displayed simultaneously
 - i. SHORT time setting and SHORT_VH, SHORT_VL setting function
 - j. LCD big display
 - k. Protections against V, I, W, and $^{\circ}$ C
 - l. Setting values can be adjusted by rotary knob or push button
 - m. Voltage meter displays the polarity positive(“+”) or negative which(“-”) is selectable.
 - n. OCP, OPP test function
 - o. Flexible Load Module configuration
 - p. Include 150 states store/recall memory
 - q. External recall key



► **Consumables**

1. Proton exchange membrane fuel cell (48 cells)
2. Hydrogen storage
3. Silicone tube

► **Requirements**

1. Hydrogen purity : 99.99%
2. high-pressure hydrogen cylinder
3. Personal computer (additional requirements)
 - (1) Intel Pentium 4 or AMD Athlon, 3.0GHz or greater
 - (2) Intel or AMD Dual Core, 2.0GHz or greater
 - (3) 2 GB RAM or greater
 - (4) 2 GB free disk space available not including installation
1280 x 1024 32-bit color video display adapter(True Color)
128 MB or greater
 - (5) DVD-ROM

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