

GFC-6100

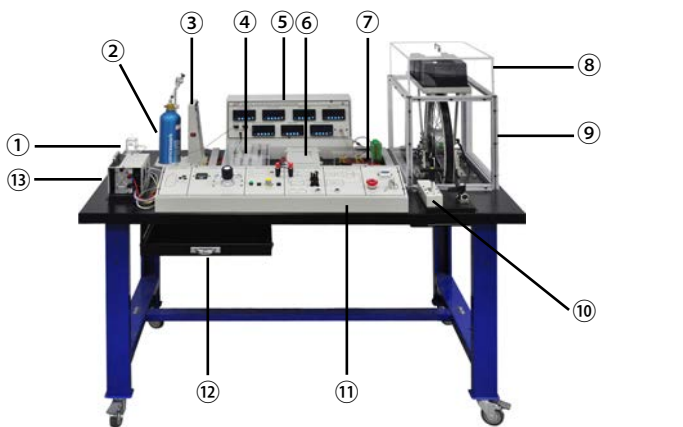
Fuel Cell Electric Vehicle Training System



A Fuel Cell Electric Vehicle (FCEV) is a hydrogen vehicle which produces electricity to power its on-board electric motor using hydrogen fuel cell. It 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 be conveniently implemented and demonstrated without connecting electric supply.
- The power source of storage battery can be either from electric supply or fuel cell.
- Data output of system panel is connectable 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 :
Switching between the two power sources, the FCEV can run either on the lithium-ion battery or hydrogen fuel cell individually or connect the lithium-ion battery to the hydrogen fuel cell series.
- 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 is running, the information of voltage, current, speed and temperature can be displayed on the instrument panel.
- Learning hydrogen fuel cell :
The training system also provides the learning experience in hydrogen fuel cells, hydrogen supply and storage and safety.



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|--|--------------------------------------|
| ① Water storage | ⑧ Load area |
| ② Hydrogen storage bottle (optional) | ⑨ Wheel motor |
| ③ Temperature feedback fans (optional) | ⑩ Acceleration and resistance device |
| ④ DC to DC Converter | ⑪ System Control Panel |
| ⑤ Meter display area | ⑫ Drawers |
| ⑥ Battery (24V/10Ah) | ⑬ Fuel Cell and Controller |
| ⑦ Motor controller | |

► Specifications

1. Water storage
Capacity : 50ml

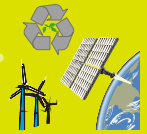


2. Hydrogen storage bottle (optional)



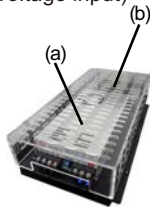
3. Temperature feedback fans (optional)
 - a. Thermocouples : J Type (-210~760°C)
 - b. Fan (can set up the activation conditions from software) ×2
Input Voltage : 24 VDC





4. 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)



5. Meter display area

- a. Fuel cell voltage meter
(1) Range : DC 0~50V
(2) Communication : RS-485
- b. Fuel cell current meter
(1) Range : DC 0~10A
(2) Communication : RS-485
- c. Battery voltage meter
(1) Range : DC 0~50V
(2) Communication : RS-485
- d. Battery current meter
(1) Range: DC -15~15A
(2) Communication : RS-485
- e. Hydrogen storage temperature meter
(1) Range : -210~760°C
(2) Setting : Hi-Lo
(3) Communication : RS-485
- f. Fuel cell temperature meter
(1) Range : -210~760°C
(2) Communication : RS-485
- g. Speedometer meter
(1) Range : 0~19999 km/h
(2) Communication : RS-485
- h. FC. temp. socket
- i. H2 temp. socket
- j. Fan power socket
- k. USB port



6. 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)



7. Motor controller

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

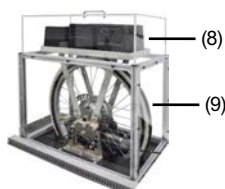


8. Load unit

Weight : 10kg x 3

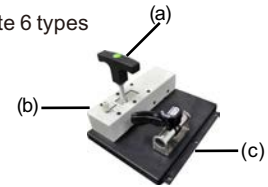
9. Wheel motor :

- a. Brushless DC motor
- b. Rated power : 200W
- c. Wheel : 20"
- d. Brake : Disc brake



10. Acceleration and resistance device

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



11. System control 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
- f. Emergency switch
- g. Battery breaker



12. Drawers

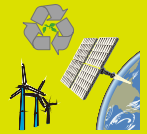


13. Fuel Cell and Controller

- 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 of fuel cell electric vehicle
2. GFC-6100 Introduction
3. Electric vehicle battery
4. Electric vehicle drive device
5. Battery electric vehicles
6. Fuel cell electric vehicles
7. Momentum of pure electric vehicles
8. The fuel cell activation
9. The voltage-current characteristic curve of the fuel cell with/without SCU
10. The impact of the fuel cell operating pressure
11. Direct fuel cell vehicles
12. Series hybrid fuel cell electric vehicles



► Standard accessories (GFC-69001)

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

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

- (1) Inlet connector : The cylinder connections has 4 types for selection.
Confirmation for required type is needed 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 accessories

1. Hydrogen storage with temperature cool down and heat up fan (GFC-69101)

- a. Hydrogen capacity : 500 L ± 5%
- b. Raw hydrogen purity : ≥ 99.99%
- c. Charging pressure : <1MPa
- d. Hydrogen purity during discharging : ≥ 99.999%
- e. Thermocouples J Type x1
- f. Split Type 3-way ball valve



2. DC Electronic load (GFC-69102)

- a. Voltage control range : 0V~60V
- b. Current control range : 0A~60A
- c. Output power : 300W
- d. 5 digital V/A/W meter
- e. Settable power ON status value
- f. High-speed measurement and communication transmission
- g. Flexible CC, CR, CV, CP, dynamic and short operation modes
- h. V/A/W values displayed simultaneously
- i. SHORT time setting and SHORT_VH, SHORT_VL setting function
- j. LCD display
- k. Protections against V, I, W, and °C
- l. Setting values adjusted by rotary knob or push button
- m. Selectable polarity positive(“+”) or negative(“-”) displayed by voltage meter
- n. OCP, OPP test function
- o. Flexible Load Module configuration
- p. 150 states store/recall memory included
- q. External recall key



► Consumables

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

► System 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 before installation
1280 x 1024 32-bit color video display adapter (True Color)
128 MB or greater
 - (5) DVD-ROM
 - (6) Operating system : Windows 8/Windows 7/Vista/XP