



GFC-6100

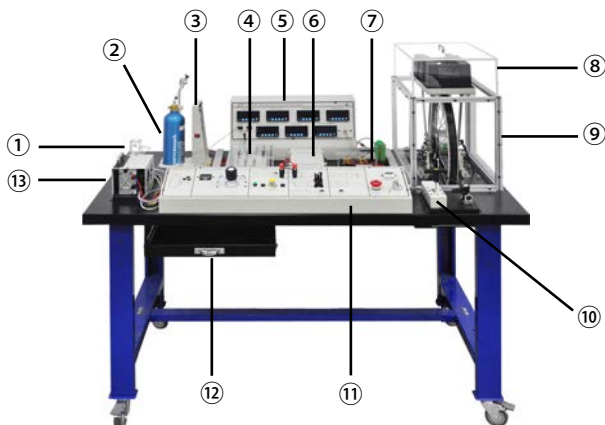
Fuel Cell Electric Vehicle Training System



A Fuel Cell Electric Vehicle (FCEV) is a hydrogen vehicle which produces electricity to power. Its on-board electric motor uses hydrogen fuel cell. It provides an effective solution saving natural resource and alleviating 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. GFC-6100 Fuel Cell Electric Vehicle Training System is designed to demonstrate the application of fuel cells onto electric vehicles, including the FCEV mechanism, fuel cell system, hydrogen supply system, and motor controller.

● Features

- The Training System can be emulated as:
 - Direct Hydrogen Fuel Cell Vehicle
 - Battery Electric Vehicle
 - Hybrid FCEV
- The Lithium-ion Battery can also be charged by external electric supply.
- Connectable to PC via USB, Software for Data Acquisition from Meters embedded in the system
- 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.
- Offering fundamental knowledge of hydrogen fuel cells, hydrogen supply, hydrogen storage and system safety.

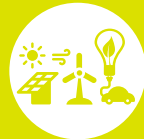


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|--|---|
| ① Water storage | ⑧ Load unit |
| ② Metal hydride canister (optional) | ⑨ Wheel motor |
| ③ Temperature feedback fans (optional) | ⑩ Acceleration and resistance device |
| ④ DC to DC Converter | ⑪ System control panel |
| ⑤ Meter display | ⑫ Drawer |
| ⑥ Battery (24V/10Ah) | ⑬ Fuel Cell stack (consumable) and controller |
| ⑦ Motor controller | |

● Specifications

- Water Storage
Capacity : 50ml
- Metal Hydride Canister (Optional)(Consumable)
 - Hydrogen capacity : 500L $\pm$ 5%
 - Raw hydrogen purity : $\geq$ 99.99%
 - Charging pressure : < 1MPa
 - Hydrogen purity during discharging : $\geq$ 99.999%
- Temperature Feedback Fans (optional)
 - Thermocouples : J type (-210°C~760°C)
 - Fan (can set up the activation conditions from software) $\times$ 2
Input voltage : 24V DC





4. DC to DC Converter

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



5. Meter Display

- (1) Fuel cell voltage meter
 - a. Range : 0~50V DC
 - b. Communication : RS-485
- (2) Fuel cell current meter
 - a. Range : 0~10A DC
 - b. Communication : RS-485
- (3) Battery voltage meter
 - a. Range : 0~50V DC
 - b. Communication : RS-485
- (4) Battery current meter
 - a. Range: -15A ~15A DC
 - b. Communication : RS-485
- (5) Hydrogen storage temperature meter
 - a. Range : -210°C~760°C
 - b. Setting : Hi-Lo
 - c. Communication : RS-485
- (6) Fuel cell temperature meter
 - a. Range : -210°C~760°C
 - b. Communication : RS-485
- (7) Speedometer meter
 - a. Range : 0~19999km/h
 - b. Communication : RS-485
- (8) FC. temp. socket
- (9) H₂ temp. socket
- (10) Fan power socket
- (11) USB port



6. Battery

- (1) Battery type : lithium-ion
- (2) Battery configuration : 7S1P
- (3) Nominal voltage : 25.9V
- (4) Typical capacity : 10Ah
- (5) Max. charging voltage : 29.4V
- (6) Discharge cut-off voltage : 19.6V
- (7) Max. discharging current : 20A
- (8) Standard charge : 2A
- (9) Max. charging current : 5A
- (10) Operating temperature :
0~45°C (charging)
-10°C~50°C (discharging)



7. Motor Controller

- (1) Input voltage : 24V DC
- (2) Motor hall sensor
- (3) Speed adjustable

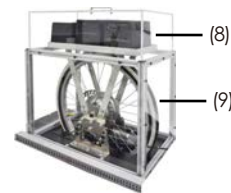


8. Load Unit

Weight : 10kg x 3

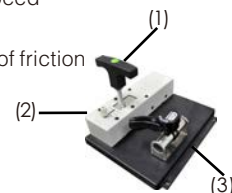
9. Wheel Motor :

- (1) Brushless DC motor
- (2) Rated power : 200W
- (3) Wheel : 20"
- (4) Brake : disc brake



10. Acceleration and Resistance Device

- (1) Constant speed controller : 3 types of speed
- (2) Accelerator
- (3) Friction controller : can emulate 6 types of friction



11. System Control Panel

- (1) Divided into 5 functional blocks
 - a. Hydrogen storage
 - b. Hydrogen regulator
 - Inlet pressure gauge : 0~400psi
 - Outlet pressure gauge : 0~30psi
 - c. Hydrogen fuel cell
 - Short circuit unit
 - Fan tachometer control
 - d. DC to DC converter & li battery
 - e. Motor controller
- (2) Protection block
 - a. Emergency switch
 - b. Key switch
 - c. Battery breaker



12. Drawer

(40.5(L) x 42(W))cm

13. Fuel Cell Stack (Consumable) and Controller

Fuel Cell:

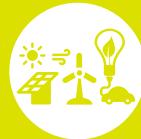
- (1) Performance
 - a. Rated power : 200W
 - b. Rated voltage : 28V
 - c. Rated current : 7.2A
 - d. Voltage range : 24V~46V
- (2) Fuel
 - a. Pure hydrogen : > 99.95%
 - b. Pressure : 0.45bar~0.55bar
 - c. Hydrogen consumption: 2.8L/min
 - d. Oxidant / coolant : Air
- (3) Operating environment
 - a.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



Controller:

- (1) Overheat protection
- (2) Low voltage protection
- (3) Overcurrent protection
- (4) Fan tachometer control
- (5) Short Control Unit (SCU) switch
- (6) Purging valve
- (7) Start switch





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

Accessories (GFC-69001)

1. Experiment Manual
2. Connection Leads and Plugs : 1set
3. CD : software
4. 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

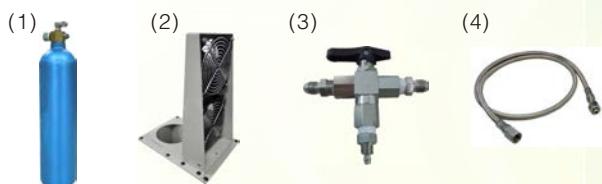
(2) Inlet pressure gauge : 0~400bar

(3) Outlet pressure gauge : 0~16bar



Optional

1. Hydrogen Storage (GFC-69101)
 - (1) Metal hydride canister
 - (2) Temperature feedback fans
 - (3) Split Type 3-way ball valve
 - (4) Teflon flexible tube



2. DC Electronic Load (GFC-69102)

- (1) Voltage control range : 0~60V
- (2) Current control range : 0~60A
- (3) Output power : 300W
- (4) 5 digital V/A/W meter
- (5) 150 store/recall memory for status value when powered on
- (6) High-speed measurement and communication transmission
- (7) Flexible CC, CR, CV, CP, dynamic and short operation modes
- (8) V/A/W values displayed simultaneously
- (9) SHORT time setting and SHORT_VH, SHORT_VL setting function
- (10) LCD display
- (11) Protections against V, I, W, and °C
- (12) Setting values adjusted by rotary knob or push button
- (13) Selectable positive ("+") or negative polarity ("-") displayed by voltage meter
- (14) OCP, OPP test function
- (15) Flexible load module configuration
- (16) External recall key



Consumables

1. Proton Exchange Membrane Fuel Cell (48 cells)
2. Metal Hydride Canister
3. Silicone Tube

Requirements

1. Hydrogen Purity : 99.99% (It is necessary to prepare locally)
2. Personal Computer

System Requirement

1. PC : 1GHz or faster 32-bit (x86) or 64-bit (x64) processor, 2GB RAM, 2GB more free disk space
2. OS : Windows XP / Vista / 7 / 8 / 10