

Operating Instructions

F101 Fuel Cell H_2/O_2

F102 Double Fuel Cell H_2/O_2

F103 Fuel Cell $H_2/O_2/Air$

F104 Double Fuel Cell $H_2/O_2/Air$

Overview

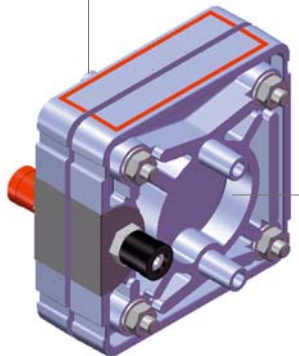
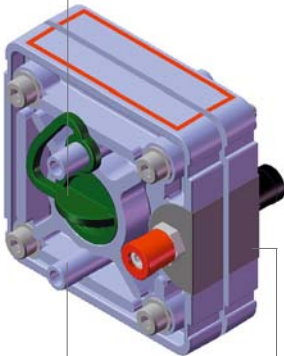
Fuel Cell $H_2/O_2/Air$

Fuel Cell H_2/O_2

Stopper

Oxygen- (O_2) side

Hydrogen- (H_2) side



Air- side

Hydrogen- (H_2) side

General Safety Precautions

- The units may only be set up and operated by a responsible supervisor.
 - **WARNING!** Not suitable for children under 12 years!
 - Read the Operating Instructions before setting up the fuel cell. Follow them during use and keep them readily available for reference.
 - Wear protective goggles.
 - Equipment and gases must be used and stored out of the reach of small children.
 - Plug-in power supplies can be dangerous - they are not toys!
 - Disconnect the unit from the plug-in power supply and the solar module before cleaning with liquids.
 - Unless instructed to the contrary by the manual, do not reverse or short-circuit the connecting terminals.
 - The units must not be operated when empty. Always ensure that they contain sufficient water. Pay attention to the water level marks.
 - Remove flammable gases, vapours or liquids from the area surrounding fuel cells and electrolyzers. The catalytic materials involved may cause spontaneous ignition.
 - Hydrogen and oxygen may escape from the units. Operate the units in well-ventilated rooms to ensure that the gases do not accumulate and form explosive mixtures.
 - The units may only be operated in display cases if adequate ventilation is guaranteed under all circumstances. The operator is responsible for ensuring this.
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General Safety Precautions

- Remove from the vicinity of the units anything that could ignite the hydrogen (e.g. open flame, materials that can become charged with static electricity, substances with a catalytic action).
 - Remove from the vicinity of the units all substances that could spontaneously ignite in increased oxygen concentration.
 - Do not smoke.
 - Hoses, plugs and gas tanks are used for pressure compensation. They must not be fixed or secured with clamps, adhesive, etc.
 - Only use the gas storage tanks associated with or supplied with the units. Never connect alternative gas storage tanks.
 - The units may only be operated at room temperature and ambient pressure.
 - Minimum separation distances must be observed when using solar modules and artificial lights. These are: 30 cm between h-tec solar modules and the h-tec Videolight, and 50 cm in the case of the h-tec Spotlight. When using lights from other manufacturers, observe the minimum distance specified by them.
 - **WARNING!** The surface of solar modules can get very hot during extended operation.
 - Tell your students about any potential dangers and carefully supervise experimentation.
 - h-tec accepts no responsibility for injuries or damage sustained in the event that these Safety Precautions are not followed.
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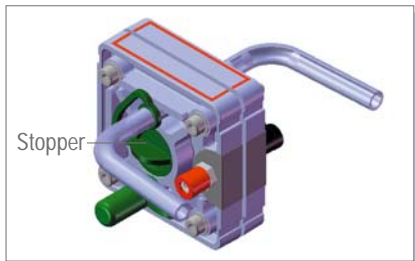
Introduction

This PEM fuel cell (PEM = Proton Exchange Membrane) produces electricity by using hydrogen and oxygen gas (or atmospheric oxygen). Its only by-products are water and heat.

H₂/O₂ Setting up

Read the Operating Instructions and the General Safety Precautions before using any of the equipment.

1. Fit caps to the bottom outlets of the fuel cell.



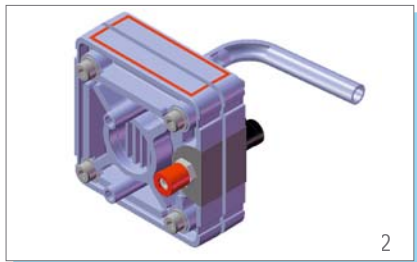
Note:

Make sure that the stopper is fitted to the air inlet.

2. Connect the gas supply (e.g. h-tec Electrolyser 10 Item No. E102) to the top gas connectors: hydrogen to the negative pole side (black) and oxygen to the positive pole side (red).
3. Connect an electrical load (e.g. h-tec Ventilator Fan Tutorial Item No. A105). When doing so, make sure that the polarity is correct (red = "+", black = "-").
4. The equipment is now ready for operation and can be used for demonstrations or experiments.

H₂/Air Setting up

When you use a Type F103 or F104 fuel cell, you also have the option of operating the cell in air-breathing mode simply by removing the stopper. When operating with atmospheric oxygen, the power of the cell is somewhat lower than when operating with pure oxygen.



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1. Fit a cap to the bottom hydrogen output of the fuel cell.
2. Remove the stopper on the oxygen side of the fuel cell.
3. Connect the hydrogen supply (e.g. h-tec Electrolyser 10 Item No. E102) to the negative pole side (black).
4. Connect an electrical load (e.g. h-tec Ventilator Fan Tutorial Item No. A105). When doing so, make sure that the polarity is correct (red = "+", black = "-").
5. The equipment is now ready for operation and can be used for demonstrations or experiments.

Accessories (not included)

- Electrolyser 5 Item No. E101
- Electrolyser 10 (for Double Fuel Cell H_2/O_2 or Double Fuel Cell $H_2/O_2/Air$) Item No. E102
- Fan Tutorial Item No. A105

The fuel cells we provide in our sets are maintenance-free. However, always remember:

Before putting the cell away:

- Continue operating the cell until the electric load (e.g. the motor) stops by itself. This will ensure that a little water remains in the cell and keeps the membrane moist.
 - Close the caps and the stopper so that the water in the cell does not evaporate quickly.
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The cell only produces low power

Cause 1:

- The cell has been stored for a very long time or is too dry. A cell with a dry membrane will lose power.

Solution 1:

- Continue to use the cell. The cell will moisten itself during operation and gradually return to full power.

Cause 2:

- Water forms in the cell during operation. This can lead to the gas supply to the cell becoming blocked.

Solution 2:

- Open the bottom caps so that moisture can escape.

The cell does not work in spite of being set up correctly

- You have connected an external voltage to the fuel cell. This leads to the immediate destruction of the catalyst. The cell is permanently damaged.
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Fuel Cell H₂/O₂ (F101)Single-cell fuel cell for H₂/O₂ operation

Power: 500 mW

H x W x D: 50 x 40 x 50 mm

Weight: 54 g

Double Fuel Cell H₂/O₂ (F102)Double-cell fuel cell for H₂/O₂ operation

Power: 1 W

H x W x D: 56 x 42 x 57 mm

Weight: 63 g

Fuel Cell H₂/O₂/Air (F103)Single-cell fuel cell for H₂/O₂ operation or H₂/Air operationPower H₂/O₂: 500 mWPower H₂/Air: 150 mW

H x W x D: 50 x 40 x 50 mm

Weight: 52 g

Double Fuel Cell H₂/O₂/Air (F104)Double-cell fuel cell for H₂/O₂ operation or H₂/Air operationPower H₂/O₂: 1 WPower H₂/Air: 300 mW

H x W x D: 56 x 42 x 40 mm

Weight: 60 g