

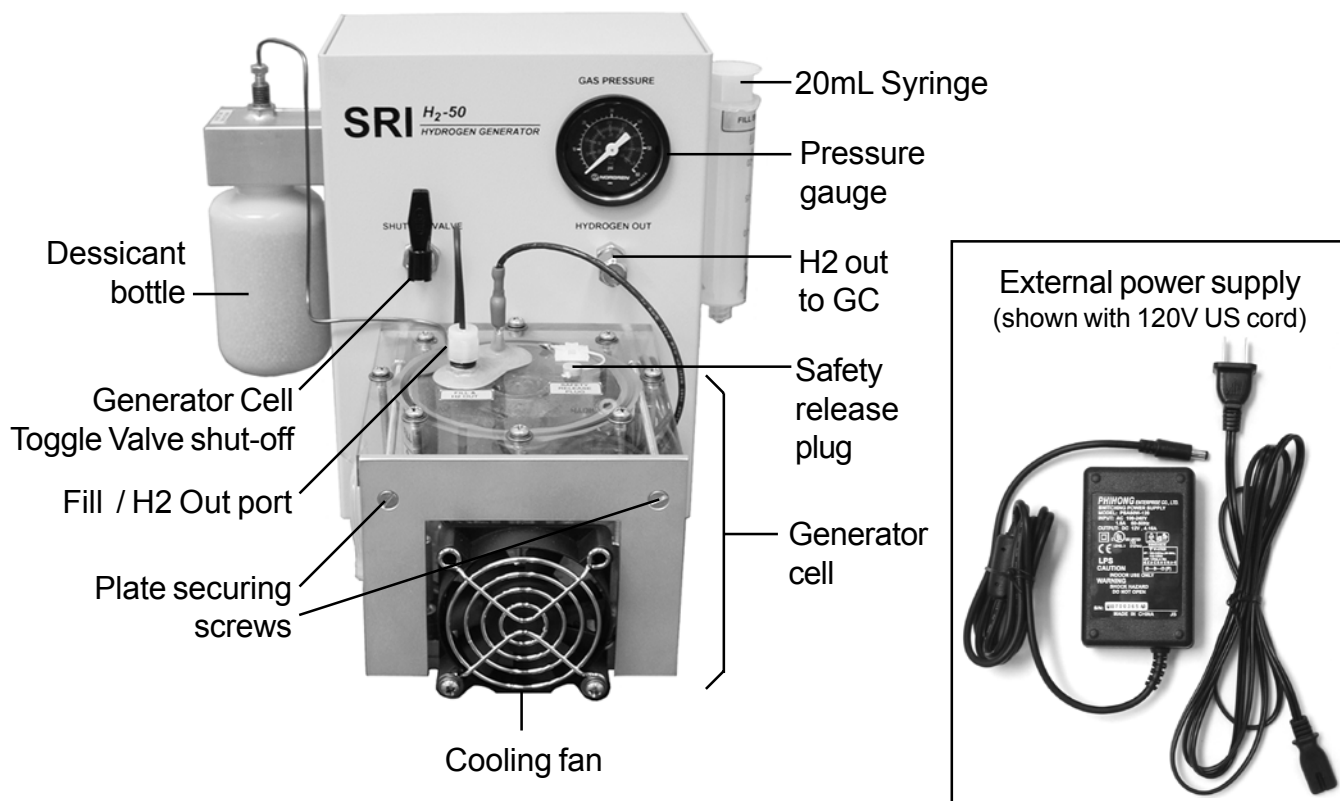
# GC ACCESSORIES

## H<sub>2</sub>-50 Stand-Alone Hydrogen Generator

### Overview

Your SRI H<sub>2</sub>-50 Stand-Alone Hydrogen Generator consists of a generator cell mounted on a metal chassis. The generator cell is attached to the chassis with two screws for easy disassembly--just unscrew them, unplug the power cord, and the entire cell comes off. On the metal chassis is a pressure gauge, an interior pressure switch, a dessicant bottle, and a toggle valve shut-off for isolating the generator cell. The dessicant bottle contains Indicating Molesieve dessicant beads which turn from blue to gray when they absorb water. Water vapor that is released from the generator cell with the hydrogen is removed by the dessicant before reaching the GC column, thus drying the hydrogen gas. The H<sub>2</sub>-50 can supply enough gas for a detector or two as well as the GC carrier gas. During operation, there is about 40mL of hydrogen gas stored in the dessicant, which is enough to operate a split injector for short periods, in addition to the detector(s) and carrier. The toggle valve shut-off facilitates checking for leaks and allows the H<sub>2</sub>-50 to reach operating pressure more quickly, while the interior pressure switch maintains the operating pressure. As a safety measure, a pressure release plug protects the generator cell from pressure overload. The external power supply with its own transformer enables the H<sub>2</sub>-50 to operate on various voltages around the world. Conveniently, the H<sub>2</sub>-50 produces 50mL/min at 30psi using distilled water from the grocery store.

The SRI H<sub>2</sub>-50



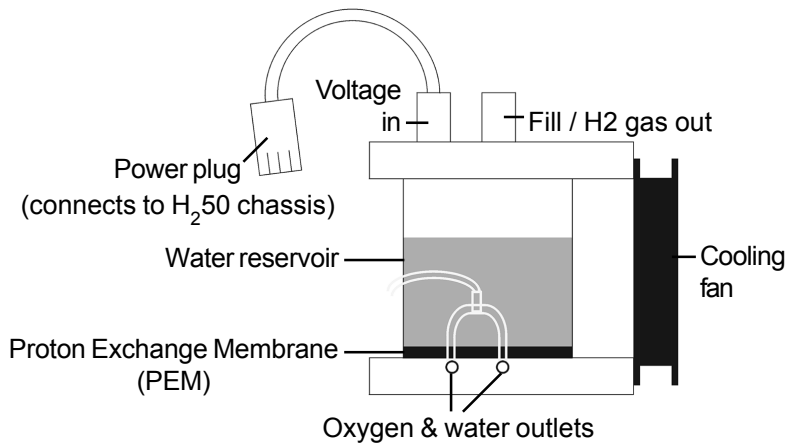
# GC ACCESSORIES

## H<sub>2</sub>-50 Stand-Alone Hydrogen Generator

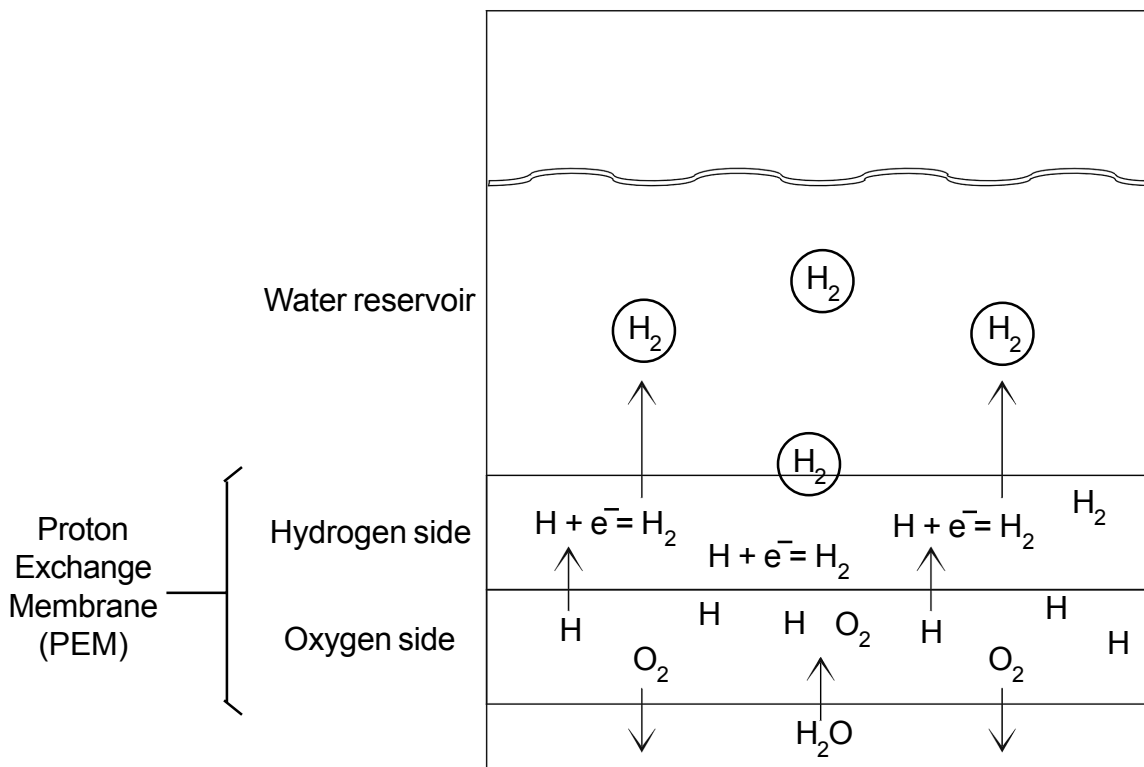
### Theory of Operation

The SRI H<sub>2</sub>-50 Hydrogen Generator separates water into hydrogen and oxygen using a Proton Exchange Membrane (PEM). The water on the oxygen side of the PEM is disassociated into O<sub>2</sub> and hydrogen protons. The hydrogen proton is transported through the PEM to the hydrogen side, where it recombines with an electron to make H<sub>2</sub>, then bubbles up through the water reservoir.

### The H<sub>2</sub>50 Generator Cell



### Operational Diagram of the H<sub>2</sub>50 Generator Cell



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### H<sub>2</sub>-50 Stand-Alone Hydrogen Generator

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#### ***General Operating Procedure***

Use the H<sub>2</sub>-50 on a flat, level surface, away from open flame and any other ignition sources, including spark sources.

1. Remove the nut with the septum from the Fill / H<sub>2</sub> Out port on the top of the generator cell.
2. Use the 20mL syringe mounted on the right-hand side of the H<sub>2</sub>-50 chassis to inject clean distilled water into the water reservoir. Although clean tap water will work in a pinch, use distilled water whenever possible. Fill only to the top fill line; do not overfill. Replace the nut and septum on the fill port and hand tighten until the nut contacts the black o-ring on the fitting.
3. Make sure the dessicant bottle contains dry beads. Dry dessicant beads are blue in color; they turn grey when wet. See below for instructions on recharging and replacing the dessicant beads.
4. Connect the H<sub>2</sub>-50's "H2 OUT" fitting to the GC's hydrogen gas inlet. Output from the H<sub>2</sub>-50 "HYDROGEN OUT" fitting is connected to the GC with 1/8" or 1/16" O.D. tubing. Make sure the red and black power cord is plugged into the H<sub>2</sub>-50 chassis, and connect the external power supply cord to the generator and a wall outlet. Make sure you have the correct input cord for the voltage you are using. Properly used, the transformer is not a spark source and poses no ignition threats.
5. Close the H<sub>2</sub> shut-off valve. Always build up pressure initially with the toggle valve shut; it will take 5-15 minutes.
6. The H<sub>2</sub> gas pressure is preset to 30psi. Once this pressure is attained, the interior pressure switch will shut off the current to the generator. The water in the generator cell reservoir should stop bubbling.
7. Wait 10 minutes to make sure that 30psi pressure is maintained. If pressure is not being maintained, there is probably a leak. Check the dessicant bottle; it should be snug against the o-ring. Make sure the Fill / H<sub>2</sub> Out port nut and septum are intact and snug. Check the bottom of the water reservoir around the PEM for moisture to ensure generator cell integrity; if you find any seepage, tighten each of the eight screws that hold the cell layers together.
8. If you find no indication of a leak after 10 minutes of stabilization at 30psi, open the toggle valve to let the H<sub>2</sub> gas flow into the GC.
9. When the water in the generator cell water reservoir reaches the bottom fill line, it is time to refill it.
10. Close the toggle valve.
11. Unscrew the Fill / H<sub>2</sub> Out port nut and septum and use the syringe to refill the cell to the top fill line.
12. Replace the nut and septum, and tighten until snug.
13. Since you have the cell pressure vented, it is a good idea to check the dessicant for any grey coloring to see if the beads need recharging. If they do, follow the instructions on the next page (***General Operating Procedure continued***).

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### H<sub>2</sub>-50 Stand-Alone Hydrogen Generator

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#### *General Operating Procedure continued*

#### **Recharging and Replacing the Dessicant Beads**

Periodic recharging of the dessicant beads will be necessary as they absorb water during operation and turn grey.

1. Before you loosen the dessicant bottle on the H<sub>2</sub>-50 chassis, vent the hydrogen pressure in the generator cell by unscrewing the nut capping the fill port on the top of the cell. It will hiss audibly until it is released.
2. Dry the dessicant beads by pouring them onto a paper plate and cooking them in a microwave oven for 2-3 minutes. Or, pour them onto a glass or metal pan and bake them in the GC oven at 250°C. Do not microwave or bake the plastic dessicant bottle. The dessicant beads can be recharged over and over again; they last indefinitely. Should you need them, dry dessicant beads are available in kilogram quantities from Alltech (1-800-ALLTECH; part # 05553).
3. Let the beads cool, especially after microwaving them. Refill the dessicant bottle with the dry, blue beads.
4. Replace the bottle on the H<sub>2</sub>-50 chassis and hand tighten it. There is an o-ring that engages with the bottle top; tighten the bottle until it is snug against the o-ring.
5. The dry dessicant contains some air which will purge out during the first few minutes of operation. You may notice your retention times change temporarily since the carrier gas may initially be a mixture of hydrogen and air for a few minutes after dessicant replacement. The FID flame may also be hard to light until pure hydrogen comes through. You can speed up this equilibration process by building up pressure in the generator cell then venting with the toggle valve 2-3 times before reconnecting the H<sub>2</sub>-50 to the GC. Keep in mind that the internal pressure switch will cut the current when the cell reaches 30psi, so you don't need to build up too much pressure before venting it. Experiment to learn what works best for your particular GC system.

## GC ACCESSORIES

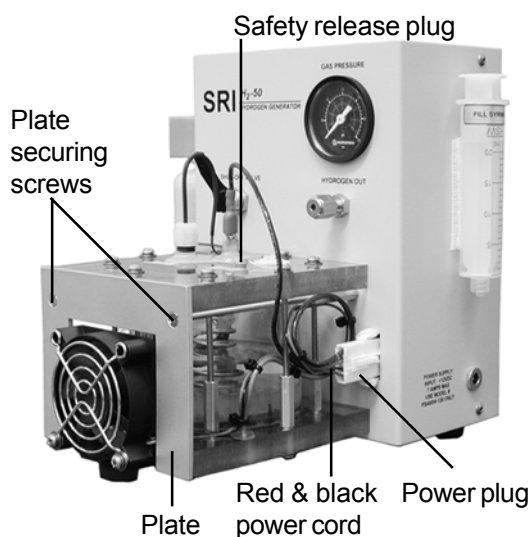
### H<sub>2</sub>-50 Stand-Alone Hydrogen Generator

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#### ***Maintenance and Troubleshooting***

If the water in the H<sub>2</sub>-50 water reservoir looks cloudy, it needs to be replaced:

1. Remove the nut with the septum from the Fill / H<sub>2</sub> Out port on the top of the generator cell. Carefully pull out the safety release plug.
3. Turn the generator over and pour the water out. When the water is almost all out, shake the generator to help it drain.
4. Carefully replace the safety plug by inserting it into the hole at an angle, then working the rest of it into place. Do not use any sharp, hard objects, including fingernails; if the plug is torn or cut in any way, it cannot perform its safety function, and may pop out under normal operating pressure. Use something with blunt edges, like a wooden popsicle stick or the rounded corner of a plastic ruler, and be gentle.
5. Open the Fill / H<sub>2</sub> Out port, and use the syringe to refill the water reservoir with clean, distilled water.



***See the following page for PEM replacement***

## GC ACCESSORIES

### H<sub>2</sub>-50 Stand-Alone Hydrogen Generator

#### *Maintenance and Troubleshooting continued*

If the Proton Exchange Membrane (PEM) changes color, it most likely needs to be replaced. New H<sub>2</sub>-50 PEMs are available from SRI under part # 8690-0151.

1. Put the replacement PEM in clean distilled water to soak while you take apart the generator cell.
2. Remove the generator cell from the H<sub>2</sub>-50 chassis by unplugging the red and black power cord from the chassis, and unscrewing the two screws that hold the clamping plate against the cell.

3. Loosen the eight screws that hold the water reservoir with a philips head screwdriver. Loosen each screw in increments; first one, then the one opposite, and so on in a star-like pattern. As you progress, be mindful of the spring in the water reservoir; don't loosen the screws too suddenly, or it may pop open the reservoir, presenting safety and damage risks. You can feel the pressure of the spring relax as you loosen the screws sufficiently; hold the top of the generator cell firmly with one hand while loosening the screws with the other.

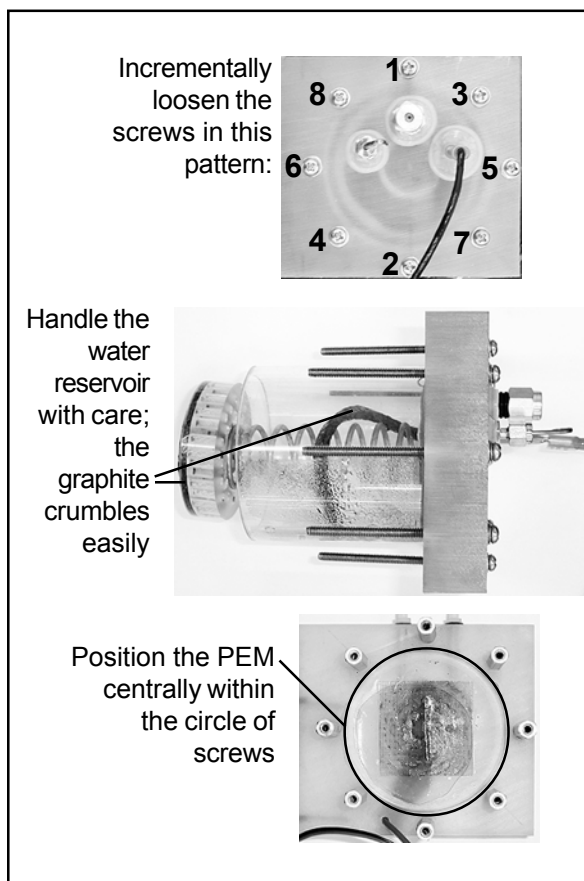
4. Once the screws are removed, carefully take the water reservoir off the bottom of the cell and remove the old PEM. Be very careful handling and moving the graphite coil, as it can easily come apart.

5. Take the new PEM out of its bath and position it centrally within the ring of screws. Place the water reservoir back on the bottom, over the PEM; the PEM should protrude slightly on all sides of the water reservoir.

6. Once the PEM is properly positioned, tighten the screws in increments until the water reservoir is snug against the bottom of the generator cell.

7. Put the generator cell back on the chassis and secure it with the plate and two screws. Plug the red and black power cord into the chassis.

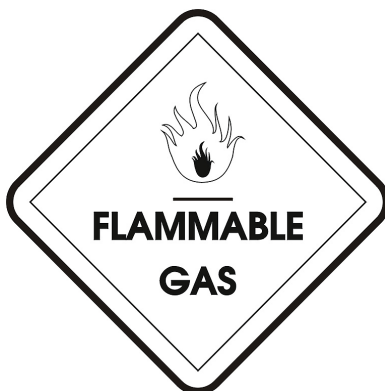
8. Plug the H<sub>2</sub>-50 into a wall outlet and pressurize the generator cell to 30psi. Check the bottom of the water reservoir around the PEM for moisture; if you see any seepage, tighten each of the eight screws a little more.



**GC ACCESSORIES**  
**H<sub>2</sub>-50 Stand-Alone Hydrogen Generator**

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**WARNING!**



***Warnings and Safety Precautions:***

The H<sub>2</sub>-50 generates hydrogen, which is an extremely flammable gas. Under normal operation, the safety features of the H<sub>2</sub>-50 protect the operator. However, operators must use common sense and take basic precautions. Hydrogen burns with a flame that is invisible to the naked eye. Do not use the H<sub>2</sub>-50 near any flames, sparks, or sources thereof, including lab ovens, heater elements, bunsen burners, torches, etc. Hydrogen is non-toxic, but it can cause asphyxiation in confined spaces by displacing oxygen. Use the H<sub>2</sub>-50 in a ventilated room with an ambient temperature of 40-100°F. If the GC power is interrupted or cut off during hydrogen generation, flip the toggle valve to isolate the generator cell, then disconnect the external power source from the H<sub>2</sub>-50 and the wall outlet. If the safety release plug pops out of the generator cell, flip the toggle valve and cut the power. This is a good general response in any situation of uncertain risk; if you're not sure what's happening, isolate the cell and pull the power plug. That way, you can take the time to diagnose any problems without H<sub>2</sub> accumulation. Familiarize yourself with the safe operation of the GC (or other equipment) to which you intend to connect the H<sub>2</sub>-50.

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**WARNING!**