Schmidlin
Swiss Made Innovation

ISO 9001 : 2000 CERTIFIED

Hydrogen Generator

PG Plus

User's Manual

Table of contents

INTRODUCTION

Scope of the manual

This manual provides operation and maintenance instructions for model PGH2-100, PGH2-160, PGH2-250, PGH2-300, PGH2-500, PGH2-600 and hydrogen generators.

Specifications

Hydrogen flow rate STP: Standard temperature and pressure (20°C, 1 bar)	Model PGH2 Plus-100 Model PGH2 Plus-160 Model PGH2 Plus-250 Model PGH2 Plus-300 Model PGH2 Plus-500 Model PGH2 Plus-600	0-100 cc/min at STP 0-160 cc/min at STP 0-250 cc/min at STP 0-300 cc/min at STP 0-500 cc/min at STP 0-600 cc/min at STP
Max outlet pressure	11 bar (160 psi)	
Purity	99.9999%	
Weight (dry)	PG Plus 100 - 160 – 250 - 300 PG Plus 500 - 600	19.5 kg 21 kg
Power consumption	Model PGH2 Plus-100 Model PGH2 Plus-160 Model PGH2 Plus-250 Model PGH2 Plus-300 Model PGH2 Plus-500 Model PGH2 Plus-600	80 W 100 W 110 W 140 W 190 W 290 W
Input voltage	110-240V / 50-60Hz	
Fuse	4A (5x20)	
Pressure accuracy	0.1 bar (± 0.5 %)	
Microprocessor controlled display	Graphic display- Touch Screen, 128 x 64 pixels	
Index of protection	IP2x	
Operating conditions: - Temperature - Relative humidity	 15°C to +40°C 0-80%, non condensing	
Over voltage category	II	
Pollution degree	2	
Sound pressure level	46 dB(A)	
Case dimensions	230 x 355 x 410 mm (WxDxH)	

Note on FCC compliance

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING!

Any changes or modifications to this equipment not expressly approved by the manufacturer may void the user's authority to operate the equipment.

Correct use

Hydrogen generator is designed to produce hydrogen for laboratory use. The unit must only be operated for this purpose, according to the specifications and instructions provided in this manual. In particular, the following warnings must be observed at all times:

- Indoor use only
- Never operate the unit in below-zero temperatures. This will cause irreversible damage to the electrolysis cell.
- Only use pure water (see “Filling the water tank”)
- Only operate the unit in a room with sufficient ventilation (see “Placing the unit”).
- Always unplug the unit from the mains power supply before accessing the internal components for replacement.
- Only the parts described in the “Spare parts list” can be replaced by the user.

Packing list

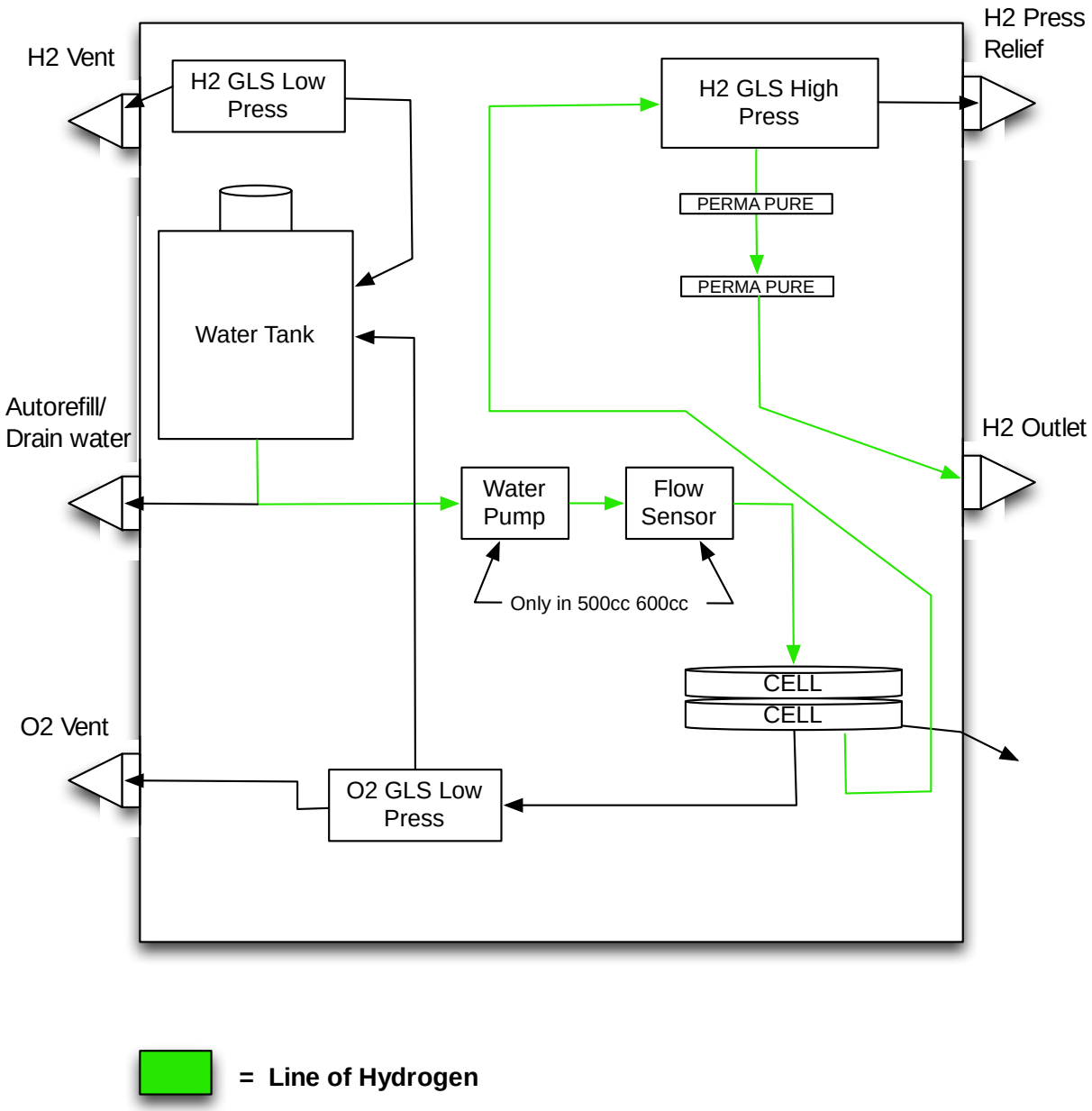
List of items included in the shipment

Quantity	Description
1	Hydrogen generator
1	Instruction manual CD
1	Deionizer triangle bag
1	Water drain with flexible tubing
1	Power cable
1	USB cable

DESCRIPTION

The hydrogen generator produces pure hydrogen (and oxygen as a by-product) by the electrolysis of water. The key element of the generator is an electrochemical cell assembly which contains a solid polymer electrolyte. No free acids or alkaline are used. De-ionized or pure, distilled water is the only liquid which may come into contact with the cell. As this is consumed it must be refilled from time to time as required.

The generated hydrogen gas is accumulated in the hydrogen/water separator and the desiccant housing. The internal pressure is controlled by a pressure transducer. The outlet pressure is controlled by a proportional valve. The hydrogen is dried by passing through the automatic dryer. The hydrogen then passes through outlet port at the rear.



= **Line of Hydrogen**

INSTALLATION

Receiving the generator

All units have been carefully inspected before transport. Visual checks for damage and functional tests should be performed upon receipt. Any damage must be immediately noted and reported. The generator must only be returned according to the shipping instructions provided.

ATTENTION: Conserve the ORIGINAL packaging is case of return.

Placing the generator

The hydrogen generator must be placed on a flat, level, vibration-free, shock-free surface. Do not place the generator over a source of heat, as this may cause the device to overheat. The unit should not be in contact with any other objects on any side, and the air inlet must not be blocked. **Leave at least 30 cm of free space at the rear for ventilation.** Do not operate the generator in a sealed or unventilated room, or in close proximity to open flame or other sources of ignition. Do not operate the generator at below freezing temperatures. Operation is guaranteed at operating temperatures between +15 and +40°C.

WARNING!

Normal precautions for any hydrogen supply should be taken when using the generator. DO NOT use in sealed or unventilated rooms. DO NOT use in close proximity of open flames or other sources of ignition.

Symbols used on the generator

Earth symbol: This symbol marks the earth connections to the chassis of the hydrogen generator.

Gas connections

Pure dry hydrogen at regulated pressure is available at the hydrogen outlet port at the rear of the generator. This port must be connected to 1/8" tubing using a stainless-steel or copper Swagelok connector. Teflon connectors are not suitable. The pressure at this port is adjusted and shown on the display. The hydrogen relief port at the rear of the unit can be connected to an exhaust hood or other vent system.

WARNING!

The line from the relief port should never connected in such a way that back pressure can develop.

IMPORTANT!

Remove the plugs from the hydrogen vent before operating the unit.

Keep these plug for transporting the unit.

Electrical connections

Check the setting of the voltage selector on the rear of the unit. The set voltage is indicated in the white square on the inlet power filter. To change the voltage, proceed as follows:

- Using a small screwdriver, remove the voltage selector insert.
- Replace the voltage selector insert so that the white arrow points to the correct voltage.

Remote connections (optional)

The hydrogen generators are fitted with an optional remote control feature(USB-RS232), which allows the user to check the status of the machine from a remote position, and to start/stop the production of hydrogen.

The contacts used in the remote control are potentially free relay contacts. The contacts can be configured via software as normally-open or normally-closed (see the Configuration section). The maximum voltage and current ratings for the contacts are 1A / 48V. The pin configuration of the remote connector is shown in the table below.

Remote connector pin configuration

Pin	Description
1+2	Start (12-30 VDC polarity not important)
3+4	Standby
5+6	Reaching external pressure
8+15	Refill water with a 24Vdc – 1A Valve. Need gravity help.
09+10	Low water level
11+12	Bad water
13+14	Change water

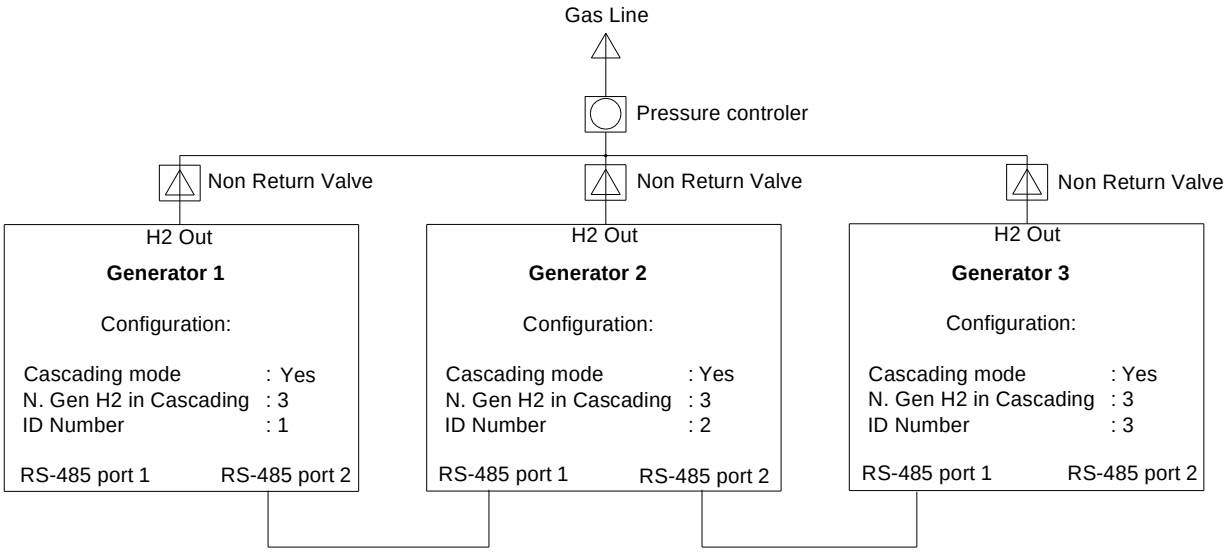
Cascading (option)

The RS-485 interface allows up to 10 generators to be operated in parallel mode. There are two modes available.

The generators are connected with a external non return valve to a gas line. The pressure must be controlled with a external pressure regulator. The outlet pressure is fixed to 10.3 bars. This mode allows up to 10 generators in a cascading group.

How does cascading work

The communication of the generators is done via the RS-485 Interface. For a correct communication each generator need a unique ID number. Each generator must know how many generators are connected in the cascading group. As soon as the generators are powered up, one generator becomes the master, and controls the others (slaves). If there is a problem with the master, one of the slave generators will become the master.
Every generator can be forced to be the master, by entering into the menu you will see the function " force to master" , just select this function and acknowledge.
When a generator is the master, you can see the letter "M" in the menu button, while the slaves show the letter "S".



IMPORTANT!

The cascading function will only work properly if the gas outlets on all the generators are connected to the same gas line.

Auto refill (option)

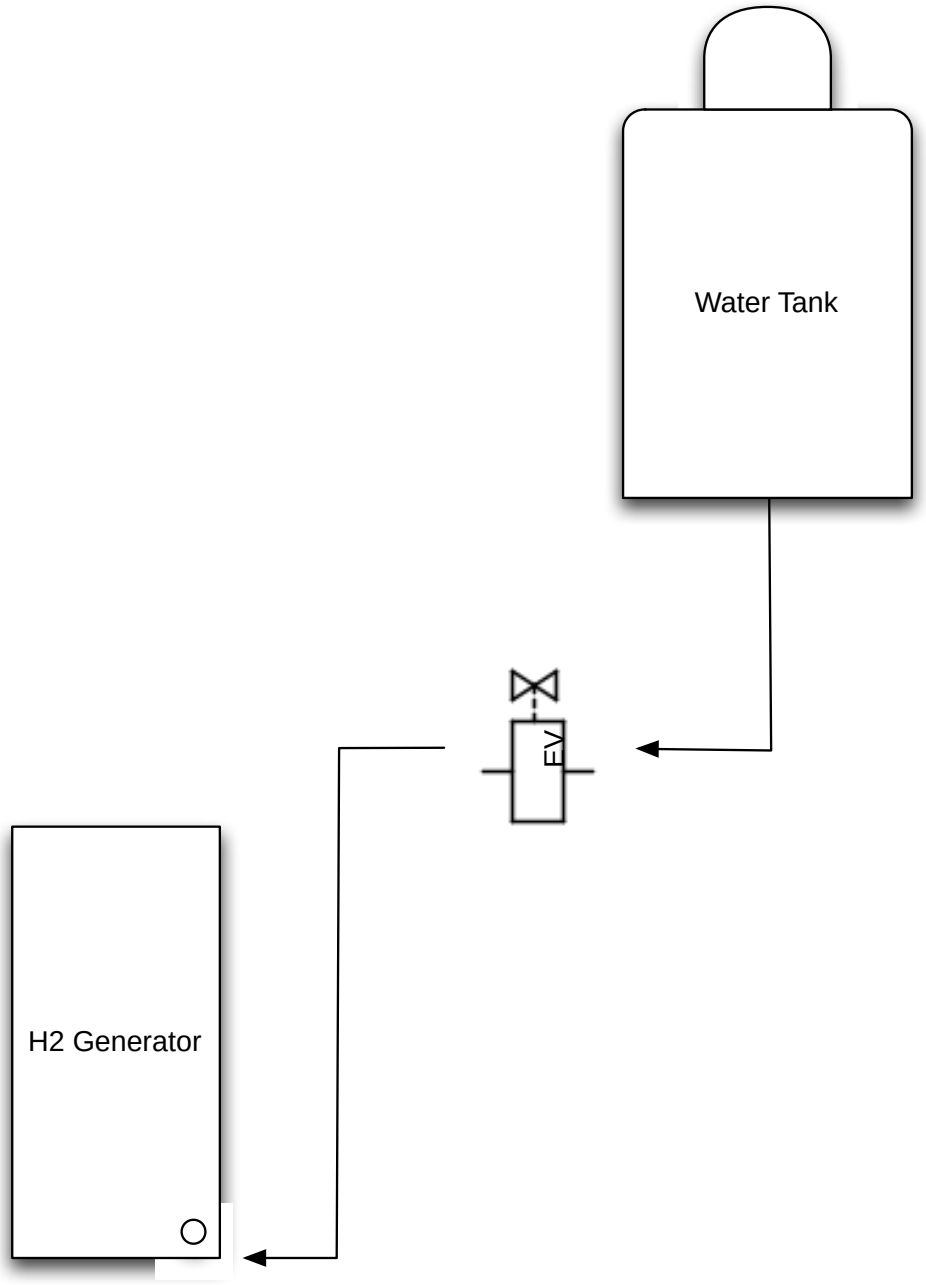
Description

The auto refill option gives you the possibility to refill the water tank of the generator automatically from an external water source. You can either use a DI water line or a water reservoir.
The kit includes a pump and a valve that assure a constant flow of water.
The system recognize itself when stops the refilling and when is time to restart it.

Installation steps

1. Connect the water tubes and the electric wires as in the diagram above.

2. Configure the generator as followed:
   - Set the generator to standby
   - Set the auto refill function to ON



INITIAL START-UP

Filling the water tank

To fill the water, remove the cap under the slider on the water tank. Carefully fill the tank with distilled or deionized water.

The conductivity of the water used in the generator must not exceed 2µS.

Fill the tank to the maximum level indicator. Close the slider cap.

WARNING!

Do not fill the water tank higher than the marked level.

CAUTION!

To prevent contamination of the cell assembly, it is important to use only deionized or distilled water in the generator. Water containing metallic impurities will contaminate or damage the cell, and will avoid the warranty.

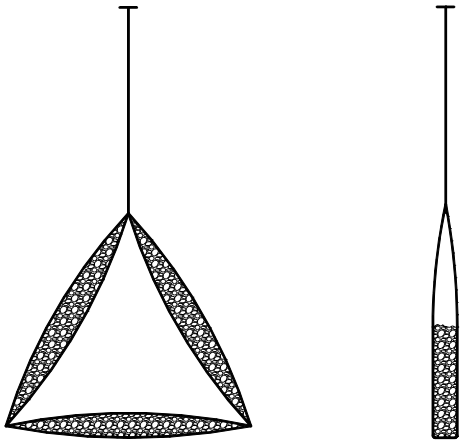
Installing the deionizer bag

The new triangle deionizer bag has been designed for a higher water purifying capacity.

It is recommendable to use this bag for new generators, in the first 4 to 6 months of operation.

After this time you can use the standard deionizer bag (see “spare parts”).

After having filled the tank with water, the triangle deionizer bag (supplied) must be placed in the tank. Inspect the bag thoroughly for holes or tears, indicated by loose deionizer beads on the outer surface. If the bag is damaged in any way, discard and replace it with a new one. Only use original parts (see *Spare Parts*). Wash the deionizer bag in deionized water before proceeding.

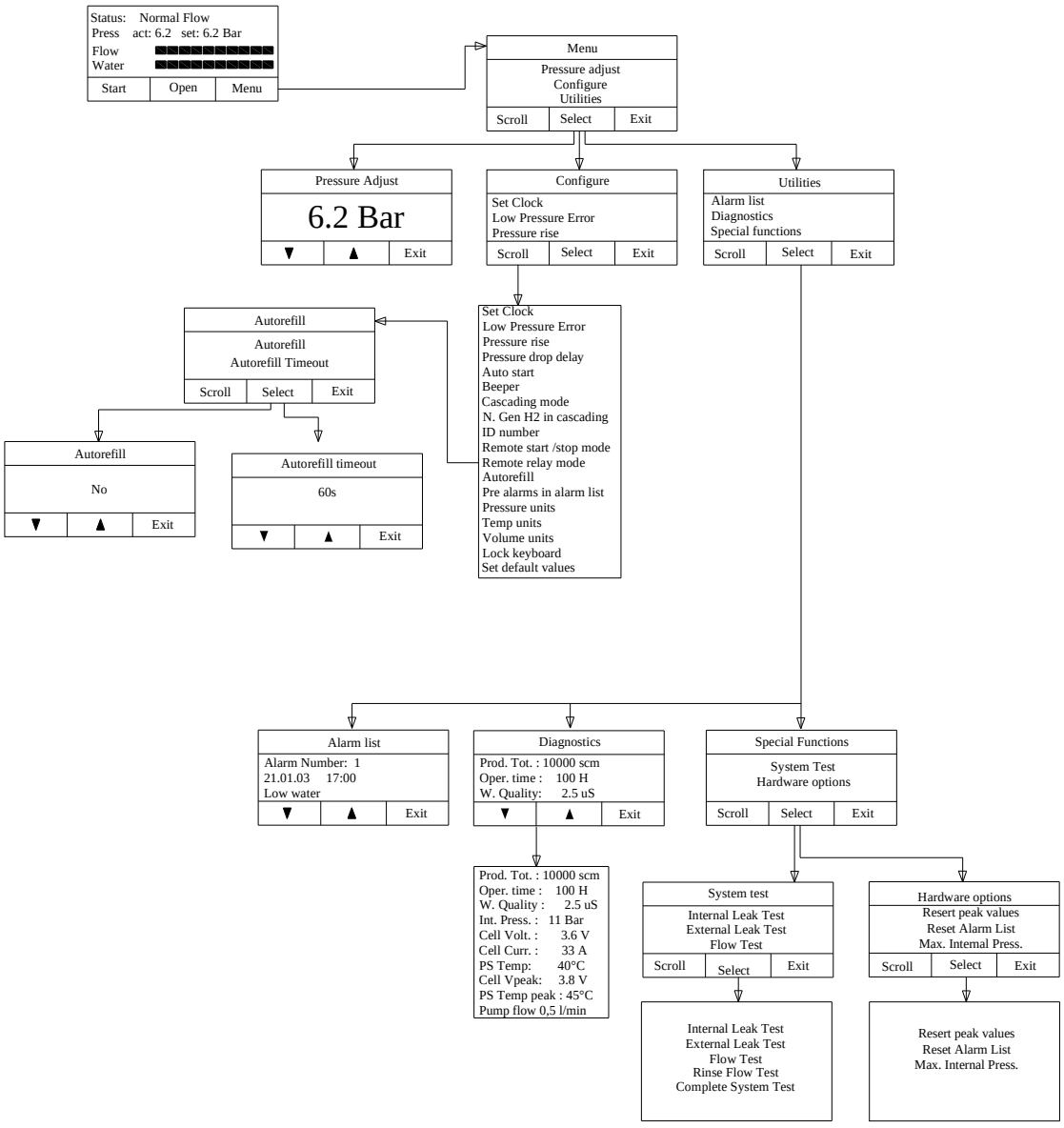


Insert the free end of the “T” fastener through the hole in the centre of the holder, until it is securely fastened. The bag should not block the outlet at the bottom of the tank. Once in place, the bag should not be allowed to dry out.

Operation

The operating status of the unit is shown on the main screen on the graphic display.

The main screen has three options at the bottom, corresponding to the three buttons on the unit and the part of touch screen, which are used to run the various functions and access the configuration and diagnostics of the unit, following the tree structure shown in the figure below.



Configure parameters

Item	Description	Options / Range	Default
Set Clock	Adjusting the internal Clock	-	-
Low Press Error*	Percentage of total pressure that has to be beat for activating the low pressure.	0-100%	30%
Pressure rise	Sets how fast the pressure has to increase. If the pressure increases at a slower rate, a low pressure alarm is activated.	0.01 – 4.2 bar/min 0.2 - 60 psi/min	0.09 14
Pressure drop delay	Sets a delay in seconds to ignore a pressure drop (override low pressure alarm)	2 - 10 min	2
Auto start	Sets whether the unit automatically starts production when power is switched on.	YES / NO	NO
Beeper	Sets whether the audible signal is activated in the event of an alarm.	ON / OFF	ON
Cascading mode	Sets the cascading mode . (see cascading for more details)	None/ Normal / Ext. P control	None
N Gen H2 in cascading	Sets the number of generators in the Cascading chain	1-10	1
ID number	Sets the ID number	1-10	1
Remote start/stop mode	Configures the remote start/stop function	Start/stop, Start only, Direct control	start/stop
Remote relay mode	Configures the remote relay contacts.	Normally open (NO) Normally closed (NC)	NC
Autorefill	If set to ON, the pre-level water alarm is used to trigger an external pump or valve to refill the water tank	ON / OFF	OFF
Pre alarms in list	If set to Yes, the pre alarms are also shown in the alarm log.	YES / NO	NO
Pressure units	Sets the desired unit of measure for the pressure	bar / psi / kPa	bar
Temp. units	Sets the desired unit of measure for the temperature	°C and °F	°C
Volume units	Sets the desired unit of measure for the volume	scm (standard cubic meters) scf (standard cubic feet)	scm
Lock Keyboard	If set to Yes, the keyboard will be locked automatically after the generator is in the main window for more than 20s. To unlock the keyboard, press the unlock button and hold for 5s.	YES / NO	NO
Set default values	Sets all configuration parameters to default		

*= If set at 100% generator never goes in External Pressure Alarm. **ATTENTION!!!**

Diagnostic display

Item	Description
Production Tot.	Total production of hydrogen
Operating time (h)	Total number of hours the unit operation
Wat. quality (μS)	Actual water conductivity
Int. Press.:	Actual internal pressure of the unit
Cell voltage (V)	Actual cell voltage
Cell current (A)	Actual cell current
PS. temp.	Actual temperature of the power supply
Cell voltage peak (V)	The maximum cell voltage in the life of the cell
PS. temp. peak	The maximum temperature of the power supply reached
Pump Flow (l/min)	Actual flow of water (only in 500-600cc models)

Special functions

Item	Description
System test	This offers several test functions see below
Internal leak test	The outlet valve is closed, the pressure is set to the max., when the pressure reaches the max., production is stopped and the pressure drop is measured over 2 minutes. The pressure drop should below 0.7 bars or 10 PSI Important: The leak test will only work if the generator is in standby mode.
External leak test	Works similar to the leak internal except the outlet valve is open and the test pressure is equal to the set pressure This function can be used to test the external gas lines Important: The leak external will only work if the generator is in standby mode.
Flow test	This functions sets the outlet valve to provide a certain flow Adjustable from 0 to 100% of maximum flow. Important: this function will only work if the generator is in standby mode. It will take approx. 2 minutes to get a stable flow!
Complete system test	Combination of all tests above
Hardware options	not available for user (password protected)

MAINTENANCE

With proper care and maintenance, your hydrogen generator should provide you with years of trouble-free operation. There are no adjustments to be made to the generator. The only routine service operations are those described below. Nonetheless, the generator should be inspected approximately every 2 years. Contact your supplier.

Routine maintenance

The following section describes the maintenance operations required for the correct operation of the hydrogen generator.

Cleaning
The internal components of the hydrogen generator do not need to be cleaned and should not be accessed by the user for cleaning. To clean the outside of the unit, only use a damp cloth (no detergents, acids or aggressive or abrasive substances.

Water refilling
The tank must be refilled when the water level approaches the lower level, and the Refill Water pre-alarm message appears.

Deionizer bag replacement
Rinse the water tank and replace the deionizer bag approximately every six months, or whenever the Change Water message appears.

Installing the new deionizer bag : See page 12 (see Installing *the deionizer bag*)

Returning the unit

In the event of any faults or damage, first notify the agent or distributor who supplied the unit. Please also provide full details of the problem, including the model and serial number. Instructions will then be provided for the service or the return of the unit. If the one year warranty has expired, or the fault is due to misuse of the unit, all repair and shipping costs are to be paid by the customer. All other costs are borne by the customer, except as otherwise expressly agreed upon.

WARNING!

*If the unit has to be transported, make sure that the water tank is **completely** empty, and place the plug (supplied with the unit) on the oxygen vent at the rear of the unit. Close the water tank with the cap. Use the ORIGINAL packaging. The unit should be transported in an upright position; this warning should be reported on the outside of the packaging*

IMPORTANT!

The manufacturer reserves the right to change or modify its products without prior notice.