



## Indoor Cabinet

For Enapter Systems 2.0 and Up

Indoor Cabinet 2.0 Manual

## Installation Manual

Rev. 06

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Enapter Srl

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Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

## CONTENT

<b>WELCOME</b> .....	<b>3</b>
Scope of the document .....	3
Approved use.....	3
<b>PREFACE</b> .....	<b>5</b>
Warnings and Hazards .....	5
General safety instructions.....	5
Hazards description .....	6
Hydrogen hazard .....	7
Mechanical Hazards.....	7
Electrical hazards .....	9
Environmental hazards .....	9
<b>TECHNICAL SPECIFICATIONS</b> .....	<b>10</b>
<b>CABINET INSTALLATION</b> .....	<b>11</b>
Placing the cabinet .....	11
Dimensions .....	12
Assembly Instructions.....	13
<b>CONNECTIONS ON THE REAR AND TOP OF THE CABINET</b> .....	<b>23</b>
Vent management design.....	26
Management of air flow .....	27
<b>SAFETY INSTRUCTIONS</b> .....	<b>28</b>
Hydrogen Storage .....	28
<b>FIRST TIME SETUP OF CABINET SYSTEM</b> .....	<b>29</b>
<b>TRANSPORT, MAINTENANCE AND RECYCLING</b> .....	<b>29</b>
Routine maintenance .....	29



Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

## WELCOME

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Thank you for choosing Enapter hydrogen generator system. Please read through this Installation Manual carefully before performing any operation.

If you have any further question on the installation of the device, please contact the Enapter Srl Help Centre. Quote the system serial number when contacting us; you will find the serial number on the type plate placed on the rear side of the modules.

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### Scope of the document

This Installation Manual provides the installer with the information needed to carry out the installation of the Cabinet 2.0. The information contained in this manual will help you to install the Hydrogen Generator System safely and as intended.

Keep this Installation Manual in a safe place and readily available. Always follow its instructions. It is the operator's responsibility to ensure that an installed cabinet is in a proper condition at all times. Please observe any additional local requirements applicable to the installation.

### Approved use

The cabinet 2.0 hydrogen generator system has been designed to produce pure hydrogen that can be used directly for Fuel Cell or other hydrogen consuming applications.

The unit must only be operated for this purpose, according to the specifications and instructions provided in this manual.



Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

Observance of this Installation Manual is part of “normal use”.



<p><b>Danger of injury due to improper use!</b> Improper use of the product can result in serious injuries.</p>
<ul style="list-style-type: none"><li>• Ensure that the manual is accessible at all times.</li><li>• Make sure you have read and understood this manual in its entirety.</li><li>• Comply with all safety instructions and warnings.</li><li>• Store the manual and other documentation in a safe place and pass them on to future owners of the product.</li><li>• Comply with all local regulations.</li></ul>

**PREFACE**

Warnings and Hazards

The following terms and symbols are used in this manual to indicate important text passages which must be given particular attention:

	Warns of dangers of fatal/serious injury
	Warns of danger of injury
	Warns of physical damage to the product
	Do not open or dismantle
	Keep away from sources of heat and ignition. No naked flames
	No smoking
	Minimum two persons required to handle the item
	Wear Personal Protective Equipment

General safety instructions

The following rules should always be observed:

- 1. Keep the work area clean.** If the work area or surface is busy the probability of injuries is higher.
- 2. Do not use the machine in dangerous environment conditions.** In order to prevent electric shock, **do not expose the machine** to rain and do not use it in a damp area. Keep the work area illuminated. **Do not use the machine** near gas or flammable substances.



Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

3. **Keep** unknown persons and children away from the machine. All unknown persons and children must keep a safe distance from the work area.
4. **Protect yourself** from electric shock. Avoid any contact with earthing surfaces.
5. **Handle** the power supply cable with care. **Do not pull** the electric cable to disconnect it from the plug. Keep the electric cable away from heat, oil and sharp edges.
6. **Use always personal protection devices:** wear protective goggles. Wear ear muffs or plugs in noisy areas. Wear gloves when handling parts with sharp edges or the conditioning solution.
7. **Disconnect** the tool from electricity if you do not use it, before maintenance and change of the accessories.
8. **Use** the machine, the tools and accessories in the way and for the purposes mentioned in this manual. Different uses and parts can cause possible risks for the operator.
9. **Get the machine repaired** by a qualified person. This electric tool is in compliance with local safety regulations. The machine must be repaired only by qualified people who use original spare parts, otherwise risks may arise for the operator.
10. **Never store** the unit at temperatures below 2°C with liquid inside the internal pipeline. This will cause irreversible damage to the electrolytic cells.
11. **Only use** demineralized water according to the specification stated in this manual
12. **Only operate** the unit in a room with sufficient ventilation

#### Hazards description

The owner/operator and the user of a device operated with hydrogen need to be aware of the potential dangers and know what to do in case of an accident or emergency. It must be ensured that the system is installed and operated in compliance with local regulations and standards.



Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

### Hydrogen hazard

Hydrogen itself is not a hazardous substance – its properties, however, can make it hazardous in interaction with other substances.

It is the User’s responsibility to implement a proper **safety area** (see specifications on par. “Safety area” of the EL 2.0 Manual).



- ✓ **Danger of death due to explosion!**
- ✓ Escaping hydrogen can ignite and burn the skin.
- ✓ Escaping hydrogen can reduce the oxygen concentration and cause respiratory difficulties.



- ✓ Do not inhale hydrogen.
- ✓ The lab/room must be equipped with a suitable ventilation system for the use of hydrogen.
- ✓ Incorporate the unit, especially the vent line, into the operational safety concept.
- ✓ The lab/room must be equipped for hydrogen monitoring.
- ✓ Avoid heat in the vicinity of the system and the hydrogen source.
- ✓ No smoking, no naked flames.



- ✓ Comply with local safety regulations.
- ✓ Comply with regulations for handling of compressed hydrogen cylinders.
- ✓ In the case of escaping gas, keep away and keep inflammable materials away.
- ✓ Prevent electrostatic charges.
- ✓ Ensure proper installation of the hydrogen supply.
- ✓ Check the hydrogen lines and connectors regularly for leak tightness

### Mechanical Hazards

As for the generic mechanical hazard that can occur during operations requiring the use of hand tools, Enapter Srl recommends wearing appropriate Personal Protective Equipment (PPE) and to use suitable tools.




- Operators protections**  
Before performing any operation, the operators must wear the appropriate PPE, such as cut resistant gloves, safety shoes, protective goggles etc.



Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11


No special training is needed to perform the preliminary steps of the installation phase. A general training regarding how to transport heavy and bulky objects, the use of electrical equipment and the application of general safety principles is sufficient.

There are residual risks associated with the manual handling of the packaging and of the device during installation that can generate:

<ul style="list-style-type: none"><li>✓ impacts due to uncontrolled movements of the load,</li><li>✓ entanglements,</li><li>✓ fallings of the load,</li><li>✓ loss of stability;</li><li>✓ overturning.</li></ul>
 <p>To prevent these risks, the packaging/cabinet must be handled by at least four people or heavy machinery.</p>

Installers must comply with the general safety principles during the handling phases.

In particular, before moving a load:

 <ul style="list-style-type: none"><li>✓ Installers must allow sufficient clearance when using aisles and passageways with openings/doorways with at least 1000 mm of free space in width and height, to grant the easy transit of the packaging and/or machine parts</li><li>✓ Installers must verify that there is no people on the passageways</li><li>✓ Installers must verify that there is sufficient visibility to grant a safe moving of materials.</li></ul>
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Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

Electrical hazards

The unit poses no special electrical hazards as long as the following instructions on safety measures are observed:



- ✓ Use only the supply voltage specified on the rating plate.
- ✓ Do not short-circuit inputs and outputs.
- ✓ Do not reverse the polarity of inputs and outputs.
- ✓ Equip the power supply line with proper protections
- ✓ Do not to short-circuit the cables of the cabinet.
- ✓ Do not insert any mechanical parts, especially metal parts, into the product through the ventilation slots.
- ✓ Do not use liquids near the product.
- ✓ Never use the product if any part of it has been immersed in water.



**WARNING!**  
Any servicing, other than cleaning and user maintenance must be performed by specialist personnel and with the power supply switched off.

Environmental hazards

The device has been designed for use in standard ambient conditions, respecting stability requirements (in absence of seismic or hydrogeological events of particular intensity).

Furthermore, the cabinet has not been designed for outdoors use and it is the User’s responsibility to protect the system and all its accessories against atmospheric phenomena such as direct sunlight, rain, snow and lightning.

**Version**

06

**Document Title**

Enapter Indoor Cabinet for Modules 2.0

**Release Date**

2020-02-11

## TECHNICAL SPECIFICATIONS

**Indoor Cabinet (for Modules 2.0+)**

Dimensions:	Width: 800mm Depth: 800mm Height: 2200mm
Weight:	130 kg (empty)
Max outlet pressure:	35 bar
Purity of hydrogen:	99.999% @ 35bar
Ambient conditions	
- Temperature:	5°C – 45°C
- Relative humidity:	20-95% non-condensing
Demineralized water input:	
- Max conductivity at 25°C:	< 20 $\mu$ S/cm (at 25° C)
Water input pressure:	0.75-4 bar
Index of protection:	IP20
Cabinet Type:	Rittal DK 5530.181



Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

## CABINET INSTALLATION




Our system components and modules are simply mounted by sliding them into their respective slots in a specially prepared 19" IT cabinet. The cabinet currently being used for Enapter's prototype EL2.0 is the Rittal TS IT enclosure, part number DK 5530.181. All internal cabling and piping will be prepared by Enapter. The customer's responsibility is simply to provide the connection to any external system for the respective piping and tubing at the rear end of the cabinet.

### Placing the cabinet

The standard cabinet is designed for indoor use or to be shielded from the elements. Due to the perforated front and back doors the protection rating for the system is IP20. Therefore, the system needs to be protected from water and care should be taken to minimize the amount of dust ingress. In addition, direct contact with sunlight should be avoided.

For indoor use it is important to ensure proper ventilation in the room of the hydrogen generator system. The ventilation must allow any hydrogen which may leak from the installation to escape and be diluted with more air. It is recommended to install fans at the roof of the room with the air intakes near the floor and to monitor the hydrogen concentration in the installation room to ensure that the hydrogen concentration is far below the flammability limit at all times.

It is highly recommended to place the cabinet on a properly designed surface, which is flat, level, vibration and shock-free. Do not place the unit near a source of heat, as this may cause the device internal temperature to overheat the enclosed systems. The perforated doors at the front and the back of the cabinet need at least 50 cm of free space in order to allow the modules contained inside to circulate air sufficiently. Do not operate the unit in close proximity of flame or other sources of ignition. Do not modify or operate the cabinet outside the herewith described operating instructions, as the cabinet contains safety critical systems to help manage the in- and outputs of the hydrogen generator systems.

	<b>Do not modify the cabinet</b>
	<b>No smoking</b>
	<b>Keep away from sources of heat and ignition. No naked flames</b>

An area of 1.5 m depth should be left clear in front of the system to ensure proper operation and in order to carry out maintenance and service work. A minimum of 0.5 meters are necessary in the back of the cabinet to install piping and connections and to allow hot air to pass out of the system unobstructed. The sides of the cabinet do not require extra space. A multitude of cabinets can be mounted together (side by side) to freely form larger systems. For information about this please look at Rittal product item code: DK 5530.181



Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

It is recommended to bolt the system to the floor with 4 screws using the holes in the plinth of the cabinet. Make sure to adjust the system until it stands level.

Remove the polystyrene on the sides of the water trap contained in the plinth of the cabinet before positioning the machine. This process is shown below.

Dimensions





The final dimensions of the cabinet, with side panels attached is 2200x800x800 mm.




Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

## Assembly Instructions



### Required tools

	Cutter
	9/16 combination wrench 5/8 combination wrench
	Stainless steel pipe cutter
	Torx screwdriver - T30
	5.5 mm flat-blade screwdriver
	Phi 2 cross-head screwdriver

### Water connections

	Plastic pipe cutter
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### Piping and tubing

Gas and purge connections:	
	Stainless steel AISI 136- ASTM A269 -1/4" X 0,89
Water connections:	
	8 mm Ø LLDPE pipe



Enapter

Version


06

Document Title

Enapter Indoor Cabinet for Modules 2.0

Release Date

2020-02-11

Vent and condensate outlet	
	10 mm Ø LLDPE pipe

### Placing the machine

Unpack the machine and remove the polystyrene on the sides of the water separation tank before positioning the machine. It is recommended to bolt the system to the floor with 4 screws using the holes in the plinth of the cabinet. Make sure to adjust the system until it stands level.

## Electrical connections

Bulkhead union 42,5 mm Ø: Power Supply

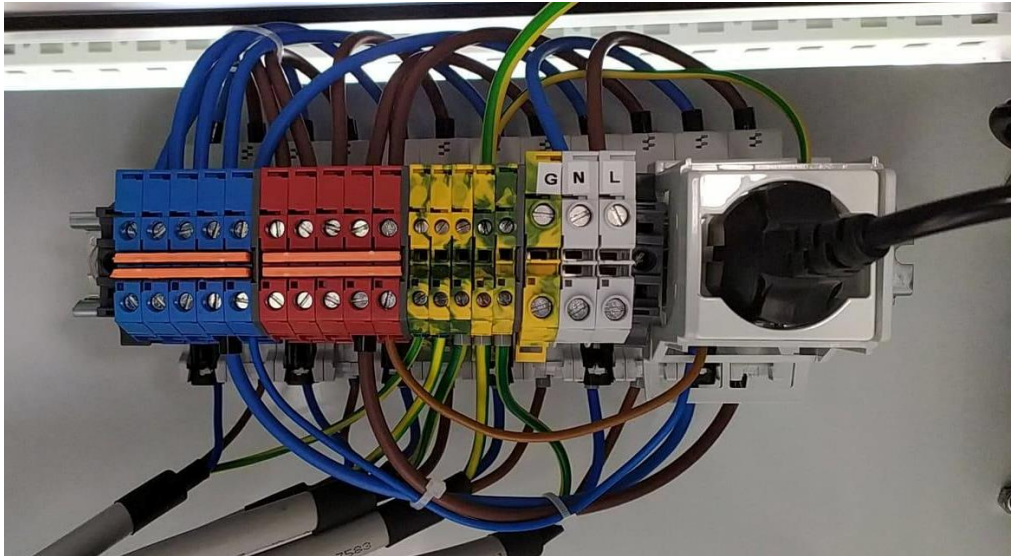


1. Push the electrical conduit into the fitting, to the stop (the conduit diameter must be 42,5 mm in Ø according to the relating port).
2. Pull on the conduit to check it is secure.
3. To disconnect, push the collet square against the fitting. With the collet held in this position the conduit can be removed.

To connect power to your hydrogen generator system a cable of suitable specification, sized for all equipment to be mounted in the cabinet, needs to be fed through the corrugate inside the cabinet into the terminal blocks. It is important to size the power cable according to the power of the equipment installed.



Connect the mains as shown below, brown (live), blue (neutral) and yellow/green (ground). Take care to never work on live wires! The wires have to be placed in the respective lodgings trough the power port referring to the stickers "G", "N" and "L".



We recommend also to install a protective device against overload and short circuits on the power supply line. The protective device must be selected in relation to the cabinet's maximum power consumption and in compliance with all local and national safety requirements.

We recommend installing a SPD (Surge Protection Device) on the power supply line in order to protect the hydrogen generator system from potential over-voltages generated by lightning strikes.

**It is the installer's responsibility to correctly dimension and install all electrical equipment upstream of the Cabinet.**

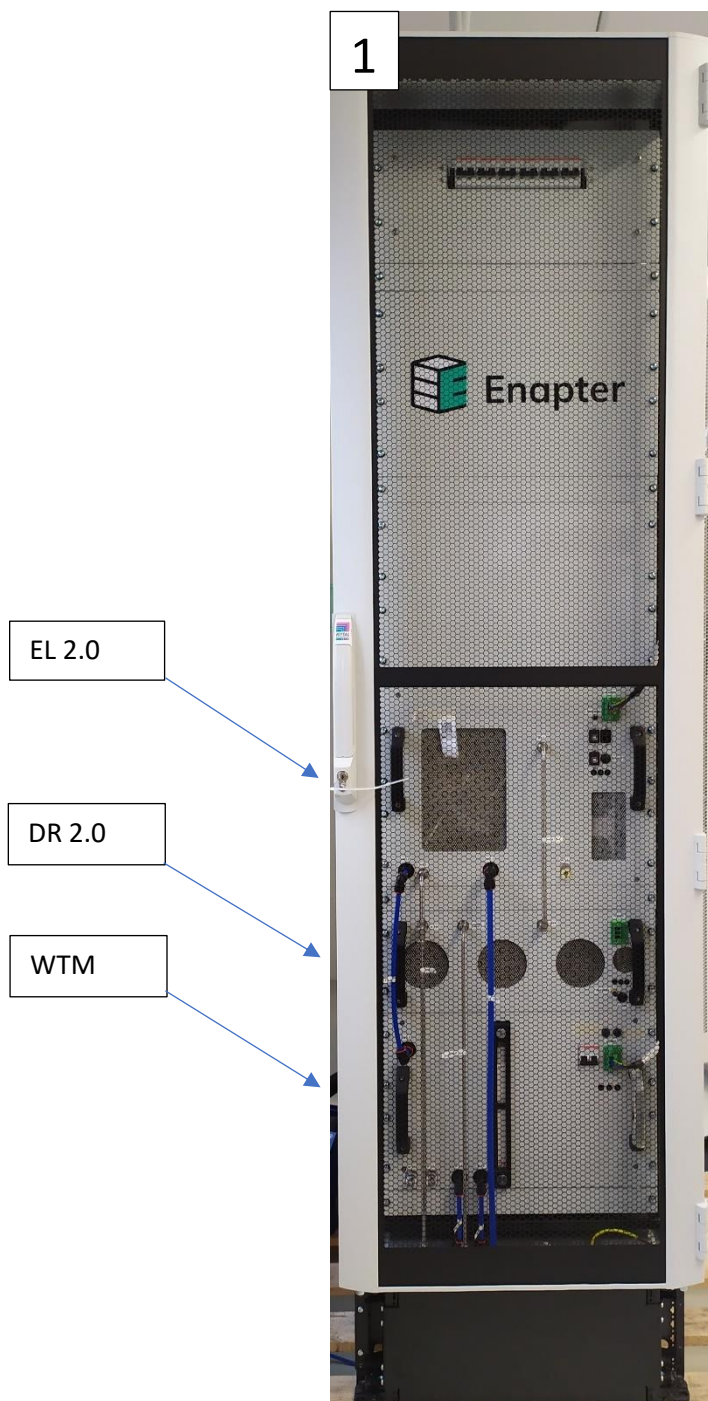




Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

### Module assembly: Gas, Water and power connections

Place the modules into the rack in the correct order: WTM (the Water Tank Module, **optional**) has to stay on the bottom, DR 2.0 (the Dryer) in the middle and EL 2.0 (the Electrolyser) on the top. Secure the modules with the supplied screws.

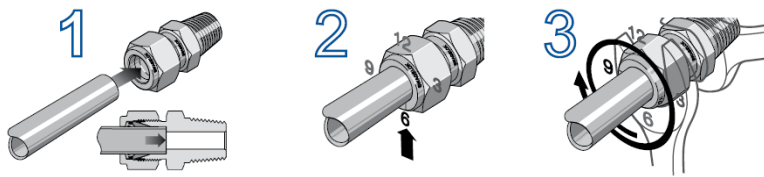


- External gas line assembling description:

Bulkhead unions: ports **H1.1** (Hydrogen outlet) and **H1.2** (Hydrogen purge)



1. Fully insert a ¼ inch stainless steel tube into the bulkhead union.
2. Rotate the nut finger-tight
3. While holding the fitting body steady with one wrench, tighten the nut with another wrench rotating clockwise.



- Water connections on the cabinet:

Bulkhead unions: ports **W1.1** (O<sub>2</sub> and H<sub>2</sub>O outlet) of 10 mm Ø and **W1.2** (Refilling H<sub>2</sub>O) of 8 mm Ø.

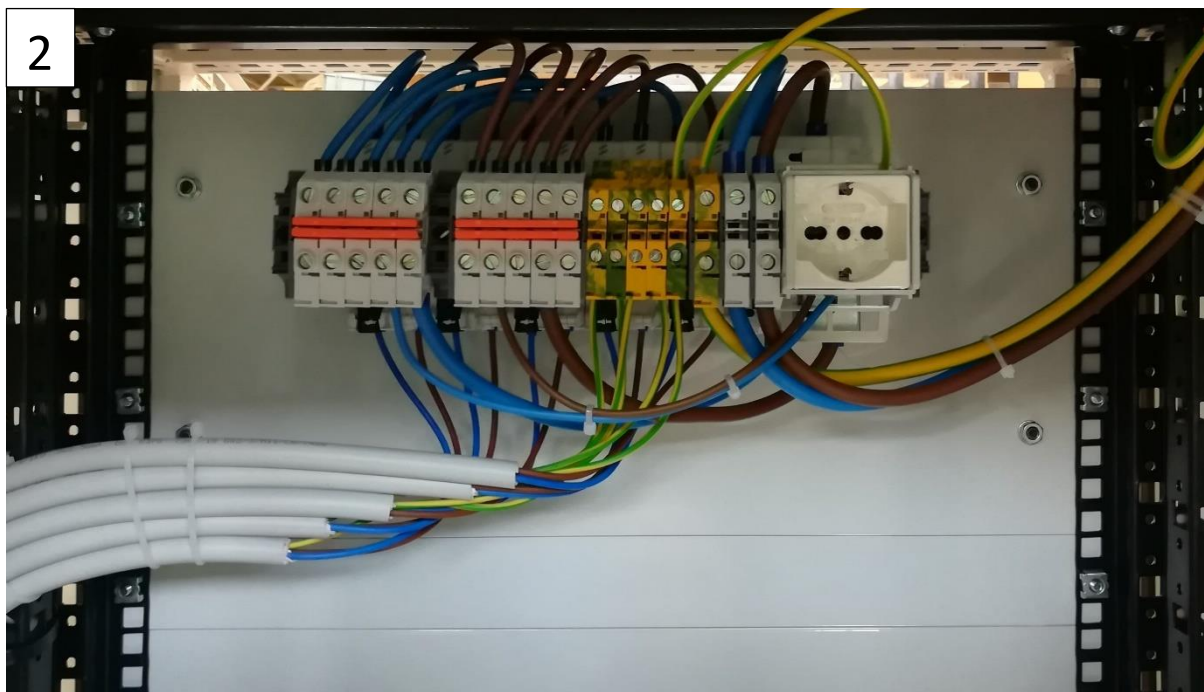


1. Cut the tube square and remove sharp edges. Ensure the outside diameter is free of score marks.
2. Push the tube into the fitting, to the tube stop (the pipe diameter must be 8 or 10 mm Ø according to the relating port).
3. Pull on the tube to check it is secure. Test the system before use.

To disconnect, ensure the system is depressurized, push the collet square against the fitting. With the collet held in this position the tube can be removed.

- Power distribution panel

The cabinet has pre-installed power cables running along the front panels. Each set of these numbered cables is connected to the respective breaker behind the “Power distribution” panel. The Gateway transformer must be inserted into the white socket, it is recommended to access this from the rear side of the cabinet.

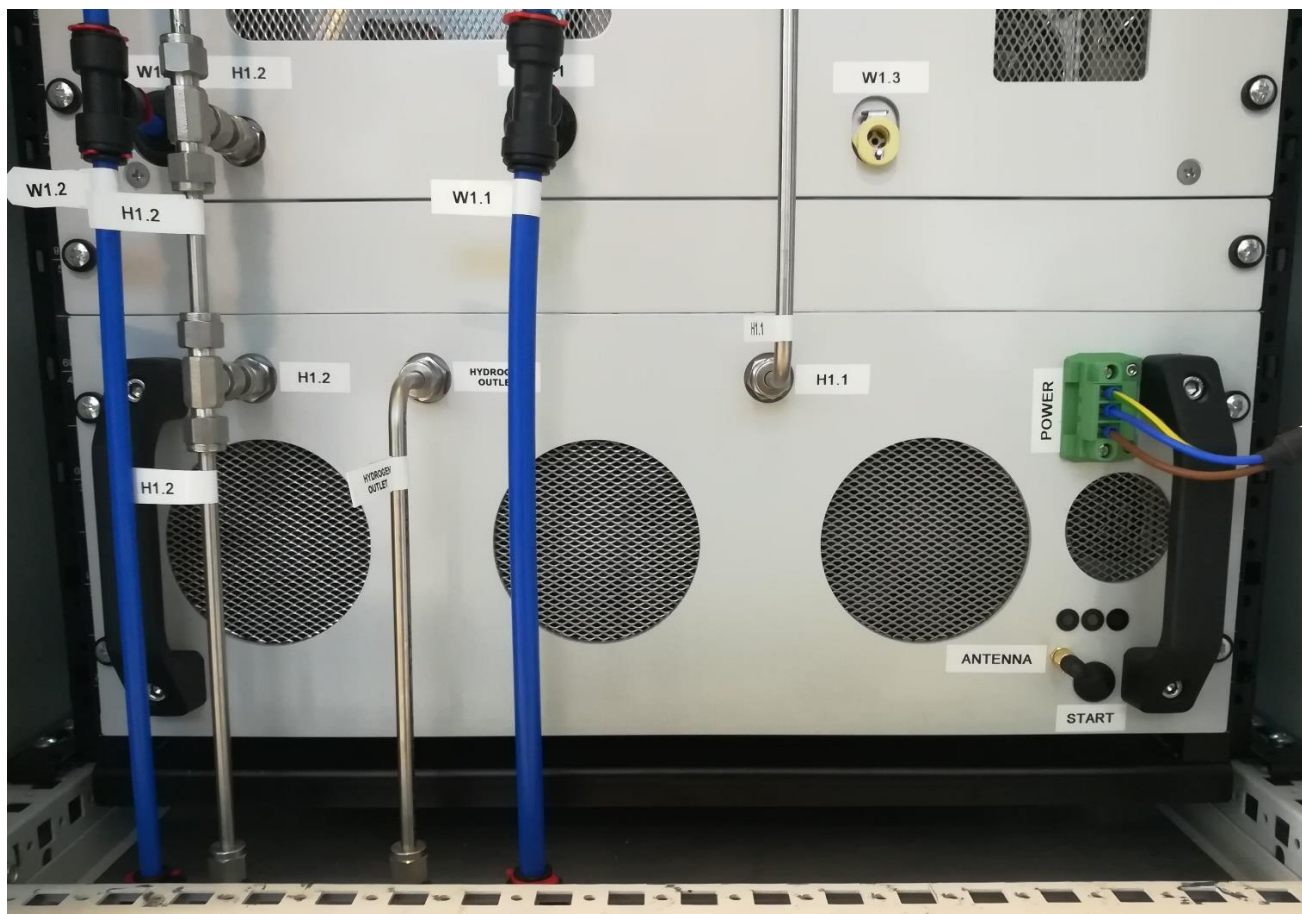




Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

### Dryer connections

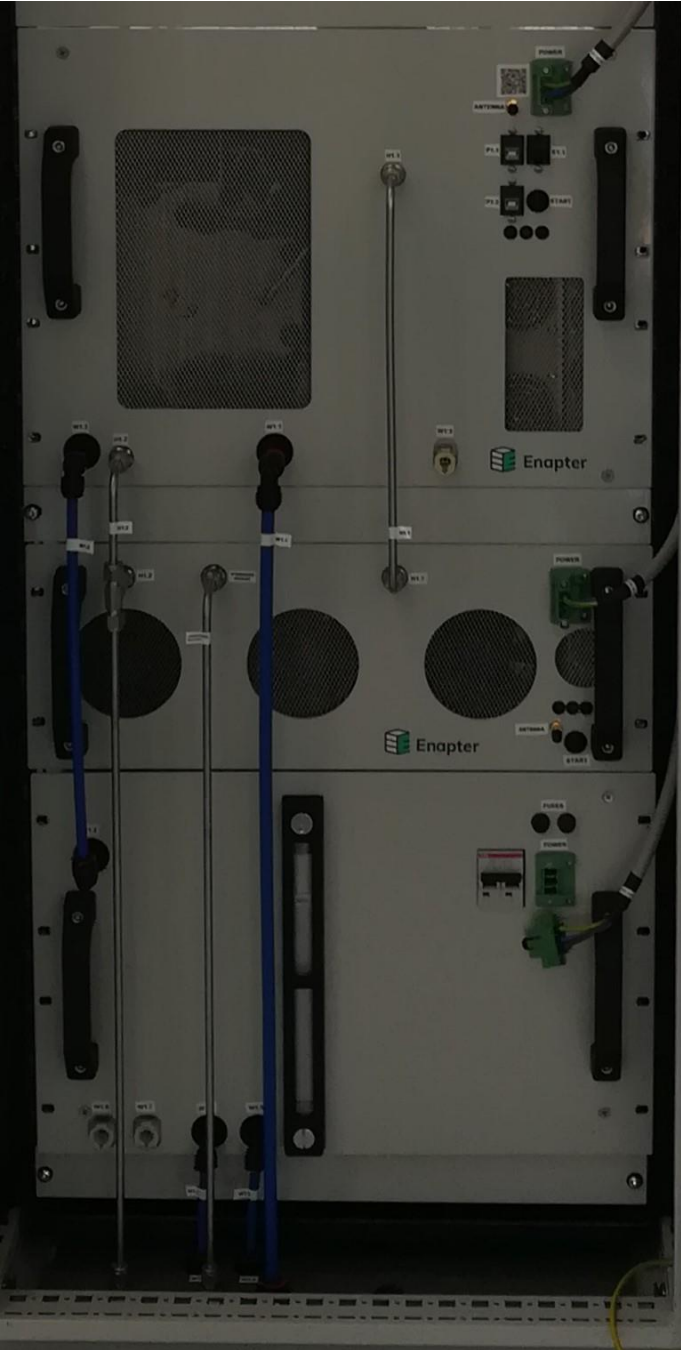
All **H1.1** ports coming from the electrolyzers should be connected to the port H1.1 of the dryer. The dry hydrogen (**hydrogen outlet**) and purge hydrogen (**H1.2**) outlets should also be connected with their respective, pre-supplied piping.





Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

The following picture shows how connections should be like.

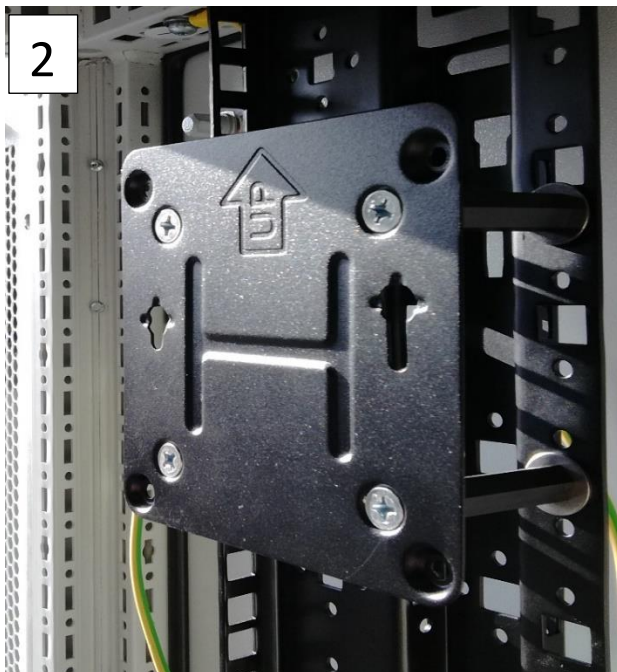




Connect the final connections pipes in the appropriate place of the front of the cabinet (picture 1):



Pictures 2 and 3 respectively represent the base in which to install the Gateway. To do this simply slide the gateway onto its mount from the top, with the same orientation as pictured above. Make sure to insert the SD card inside and plug in its power supply. Then, replace the front and right panels previously removed from the plinth.





Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

### Connections on the rear and top of the cabinet



Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

The following connections are present at the rear of the cabinet, located on the plinth and on the top of the cabinet.

1. Refilling port (plastic pipe 8 mm Ø) **(W1.2) or (W1.5)**

Automatic refilling of the systems mounted in the cabinet. Connect a DI water pipe to this bulkhead to supply the cabinet with clean water [ $< 20 \mu\text{S}/\text{cm}$  (at  $25^\circ \text{C}$ )]. The port will be labelled as W1.5 if the cabinet is equipped with a Water Tank Module.



**WARNING**

If no WTM is installed, in order to supply the EL2.0 hydrogen generator with clean DI water for refilling, the water must have a pressure between 0.75 bar and 4 bar. If the EL 2.0 does not detect the waters presence the system will not be able to refill.

2. WTM overfill port (plastic pipe 8 mm Ø) **(W1.4)**

W1.4 is the overfilling port of the tank. If no water tank module is installed, this port will not be present on the cabinet.

3. Purge (stainless steel, ¼" tube) **(H1.2)**

From this port Hydrogen gas can be expelled in order to depressurize the device or any other time it is required by the hydrogen generation process. This port must be connected with a steel pipe and vented into an external safety area. Follow the system specific instruction on how to manage the safety area.



**WARNING**

The purge line should never be blocked and should always be able to equalise its pressure to the atmospheric pressure. Do not install any check valves on the line, as this will damage the stacks in the Electrolysers.

4. H2 Outlet (stainless steel, ¼" tube) **(H1.1) or Hydrogen Outlet**

From this port the Hydrogen produced by the system can be connected to a storage tank or other User devices.



**WARNING:**

Upon installation of the external gas line, we recommend that the User to perform a hydrogen leakage test.





5. O<sub>2</sub> vent (plastic pipe 10mm Ø) **(W1.1.1)**

Humid O<sub>2</sub> with a small percentage of H<sub>2</sub> is continuously vented from this port during operation, therefore it must be connected with a plastic pipe and vented into an external safety area. The O<sub>2</sub> vent can be found on top of the cabinet. See section “*Vent Management Design*” for more information.



**WARNING:**

Never connect the pressurized water supply pipe to any outlet/vent of the system as this will cause certain damage to the hydrogen generators. Ensure to connect the water supply to the correct port!

6. Vent water drain/overflowing protection port (plastic pipe 10 mm Ø) **(W1.1.2)**

Water condensed from the O<sub>2</sub> and H<sub>2</sub> vent is drained from this port. In case of excessive presence of water due to overflowing of Electrolysers, this port allows water to safely pass through the system. It should be connected to a drain system without any increase in elevation to allow water to drain easily: it is important the inclination of the pipe does not exceed W1.1.2 bulkhead height.

7. Power conduit (Bulkhead union 42,5 mm Ø) **(POWER)**

A conduit to connect the cabinet’s power distribution unit, simply insert a cable (PG36) into the conduit and connect it underneath the plinth in the electrical supply box. A fairlead probe is preinstalled in the corrugated pipe to allow the installed to easily pull the power cable to the cabinet terminal blocks.

Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

Vent management design

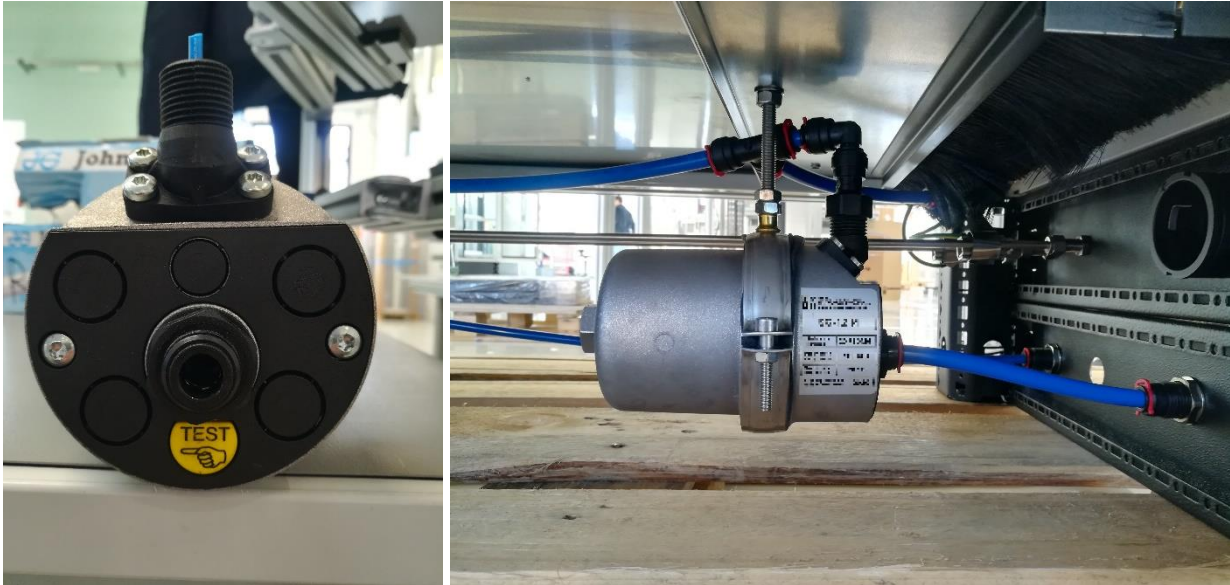
The vent consists of two separate outputs:

W1.1.1 – VENT

- This vent needs to be routed outside to a safe area. A steady output of around 250 NL/h per electrolyser of O<sub>2</sub> (and some small percentage of H<sub>2</sub>) will be vented via this port. Therefore, the output should be routed to a safe area in similar fashion as the hydrogen purge. The total length of the vent pipe connected to W1.1.1 should not exceed 15 meters.
- The vent **must not** be obstructed at any time, ensure that necessary steps are taken that the output does not become clogged or frozen shut.

W1.1.2 – OVERFILLING

- The water is separated from the rest of the vent output in a water trap below the cabinet underneath its base. A steady stream of around 20 g/hr per electrolyser will have to be drained.
- The output **must not** be obstructed, it is very important water can drain out of the line. Ensure the line is not raised 13 cm above ground level so the water has an easy way of draining out of the system.
- If the users suspects for any reason that the water trap is not functioning he can access it by removing a side panel to the plinth and pressing the test button on the from the trap. The water contained in the trap over it’s drain line should flow out and no gas should exit.





Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

Management of air flow

The intakes and vents should not be obstructed. The air flow must enter from the front and exit from the back, passing through the modules.

As noted above, a space must be kept in front and behind the cabinet, equal to the width of the cabinet and 1.5 meters and 0.5 meters in length, respectively.





Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

## Safety instructions

The cabinet is equipped with water and gas pipelines (**W1.1** “Vent/overfilling” and **H1.2** “Hydrogen purge”) which must be connected properly by the Installer/User and directed to a **safety area** (see par. “Cabinet installation”). In fact, during normal operation the system performs a periodical purge, releasing hydrogen outside the system, while the overfilling pipeline releases a mixture of vapor, hydrogen and oxygen (in addition to providing a safe pouring outside the device in case of exceeding water).

The User must comply to all safety instructions described on paragraph “Cabinet installation” (please refer to EL20, DRY and WTM manuals) and in particular:

- Do not place the device into a sealed or unventilated room
- Do not place flammable materials in proximity of the device
- Do not use naked flames/do not smoke
- Avoid any risk of explosive concentration of hydrogen
- Do not place electric equipment near the device to avoid any contact with possible escape of water from the hydrogen relief port

### Hydrogen Storage

In case of use of a compressed gas cylinder make sure that the internal pressure of the accumulator is below 35 bar (relative).

The device is protected against overpressure, but it is recommended that the operating pressure is not exceeded for the correct functioning of the electrolysis process. The safety valves of the unit will activate in case the maximum pressure reaches 40 bar, therefore if the user’s storage tank is set to a maximum pressure lower than 40 bar, it must be equipped with a safety valve properly set.



**WARNING!**

**The tank used to store hydrogen produced by the Hydrogen Generator must be standard-compliant and unblemished, and meet all local safety requirements. It must be positioned in compliance with legal provisions concerning the storage of combustive substances in force and applicable in the country in which the Electrolyser is installed. This component is not supplied by the manufacturer of the Electrolyser and must accordingly be connected under the buyer’s direct responsibility.**



Version	Document Title	Release Date
06	Enapter Indoor Cabinet for Modules 2.0	2020-02-11

## First time setup of cabinet system

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After carefully had preparing and assembling each module and making the connections, carry out another general check. Turn the system on and make sure there are not leakages from the hydrogen and water systems.

## Transport, Maintenance and Recycling

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The cabinet IP20 is designed to provide many hours of service with minimal maintenance. Proper care and maintenance by qualified personnel will help maximize the operating life of the unit.

### Routine maintenance

The unit should be inspected annually for obvious signs of physical deterioration.

Hydrogen and water connections should be tested for leakage using a combustible gas detector and visual inspection.

You are ready to use the cabinet.

Enjoy it!