ELECTROLYSER 2.1 BATTERY LIMITS

DOCUMENT N°: ELE21-BLI-INT02

Rev.	Status	Date	Revision memo	Issued by	Checked by	Approved by
00	IFP	01/10/2020	Front panel change	K.El Sherbiny	C. Poggesi	J.J.Schmidt
01	IFP	10/03/2021	Input Voltage Update/Drawing	M.Contreras/F. Bucaccio	C. Poggesi	J.J. Schmidt
02	IFP	28/04/2021	Field of application / 8 barg version included	F. Bucaccio	C. Poggesi	J.J. Schmidt
03	IFP	14/05/2021	Purge description	F. Bucaccio	C. Poggesi	J.J. Schmidt
04	IFP	26/07/2021	“Demineralised” instead “deionized”	F. Bucaccio	C. Poggesi	J.J. Schmidt
05	IFP	17/11/2021	H2O in parameter correction and reference docs update	F. Bucaccio	L. Giobbi	M. Soehner

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1 PURPOSE

The scope of this document is to define and describe the battery limits of the Electrolyser 2.1. It illustrates the physical interface ports of the Electrolyser, to allow its user to integrate it with the other equipment that composes his system.

2 FIELD OF APPLICATION

From ELE2105XXA2ASV03 to ELE2105XXA2ASVXX

3 DEFINITIONS AND ABBREVIATIONS

ELE21	Electrolyser 2.1
P&ID	Piping and Instrumentation Diagram
User	The integrator of the ELE21 in a larger system
Warranty	A written guarantee, issued to the purchaser of an ELE21 by Enapter, promising to repair or replace it as outlined in “Enapter’s Factory Warranty”

4 REFERENCE DOCUMENTS

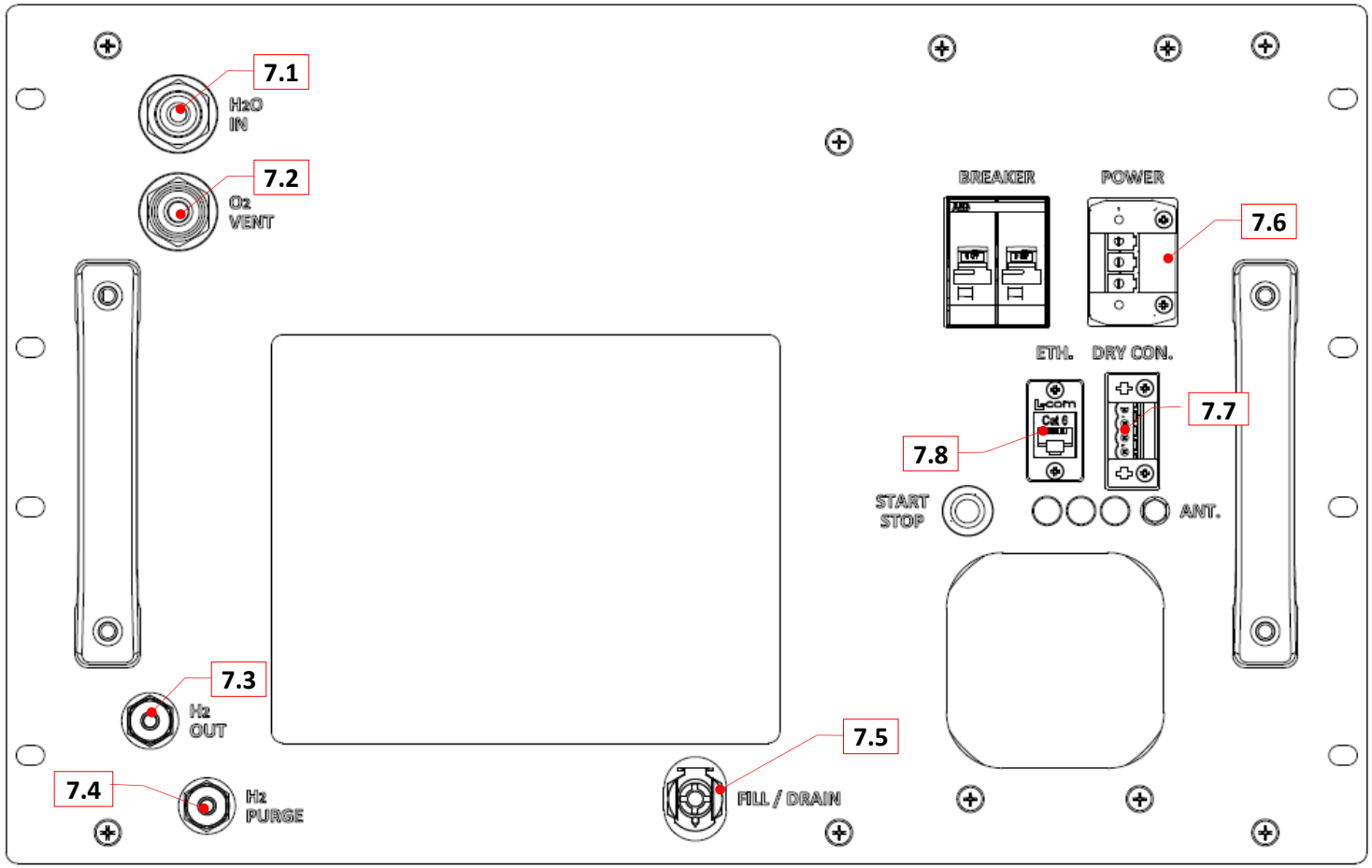
Code	Name
ELE21-PID-000RA; ELE21-PID-008RA	Electrolyser 2.1 revision A P&ID; Electrolyser 2.1 8 barG Revision A P&ID
ELE21-DRW-INT02	Electrolyser 2.1 Interfaces
GEN-MAN-ELEEN	Electrolyser 2.1 User Manual

5 RESPONSIBILITIES

User: It is the User’s responsibility to adhere to the ranges and constraints set henceforth. Failure to do so may cause the system to behave in an unpredictable/unsafe behaviour and render void the product Warranty.

6 ELECTROLYSER 2.1 INTERFACES

The following figure shows the positions of the ELE21 physical interfaces. All interfaces are located on the front panel.



7 INTERFACE SPECIFICATIONS

The values set in the following tables are operative values to be taken into account in the User system interface with ELE21.

7.1 H_2O IN

This inlet port is used for the automatic refilling of demineralised water. At the back of this port is a solenoid valve that opens when refilling is needed.

Name	H_2O IN
Fitting Type	8 mm OD Pushfit female fitting
Fitting Material	LLDPE
Fluid	Demineralised water (<20 µS/cm)
Flowrate	0-4 L/min
Pressure	1-4 barg
Temperature	6-55°C

- Water is required to be supplied to the device from a pressurised source. If the pressure is higher than 4 bar, a warning appears on the ELE21. If the pressure is too low, refilling does not start. If pressure drops below 1 barg during refilling, the ELE21 issues a warning message.
- When water with a temperature lower than 6°C is detected, an error on the ELE21 is triggered. Water with a temperature higher than 58°C also triggers an error on the ELE21 and can damage the ELE21.
- The input water must, at all times, have a conductivity lower than 20 µS/cm. Failure to do this results in accelerated degradation of the stack and damages the system.
- Any plastic piping with an outside diameter of 8 mm is compatible with the interface fitting. Particular care should be taken in selecting material resistant to KOH corrosion.

7.2 O_2 VENT

This outlet port is directly connected to the electrolyte tank, and its primary function is to evacuate the produced O_2. Apart from O_2, a small quantity of H_2 (<2% concentration) and up to 25 mL/h of H_2O vapour is part of the effluent. It is also serves as an overfill port if the ELE21 electrolyte tank is topped up with too much water due to a refilling malfunction.

Name	O_2 VENT
Fitting Type	10 mm OD Pushfit female fitting
Fitting Material	LLDPE
Fluid	O_2 + H_2O vapour+ H_2 (<2%)
Flowrate	0-250 NL/h
Pressure	0-0,5 barg
Temperature	20-55°C

- No blockage should be present on the User side of the interface. If multiple electrolysers are connected together, then Enapter supplied check valves should be installed between the Electrolyser and the main vent line. The line should be connected to a safe location open to atmosphere.
- The system is designed to withstand no more than 0,5 barg. An error on the ELE21 triggers if any overpressure is found on the line. Pressures exceeding 0,5 barg can damage the ELE21.
- The flow rate is proportional to the ELE21 H_2 production rate – i.e., at 50% of production capacity, 50% of the nominal oxygen flowrate exits the vent line.
- Any plastic piping with an outside diameter of 10 mm is compatible with the interface fitting. Particular care should be taken in selecting material resistant to KOH corrosion.

7.3 H_2 OUT

This outlet port is from which the Electrolyser produces Hydrogen. It is internally protected by a pressure control device and check valve to eliminate the possibility of gas backflow.

Name	H_2 OUT
Fitting Type	¼" double ferrule female compression fitting (Swagelok)
Fitting Material	316L Stainless Steel
Fluid	H_2
Flowrate	0-500 NL/h
Pressure	0-35 barg (35 barg version) / 0-8 barg (8 barg version)
Temperature	20-55°C

- Particular care should be taken not to attach any pressurised system with a pressure higher than 40 barg to the system.
- The outlet pressure is regulated by the User's downstream equipment. Operative pressure range should stay between 0 and 35 barg (between 0 and 8 barg for the 8 barg Electrolyser version).
- The User should connect piping with compatible material – i-e. 316L Stainless Steel.

7.4 H_2 PURGE

This outlet port is from which the Electrolyser purges all internal hydrogen and accumulated water on the cathode side. A solenoid valve is used to release pressure.

Name	H_2 PURGE
Fitting Type	¼" double ferrule female compression fitting (Swagelok)
Fitting Material	316L Stainless Steel
Fluid	H_2 + LIQUID H_2O
Flowrate	0-35 NL/sec (transient)
Pressure	0-35 barg (transient) (35 barg version) / 0-8 barg (transient) (8 barg version)
Temperature	20-55°C

- No blockage or valves should be present on the User side of the interface as critical ELE21 safety measures are dependent on it. The port should be connected to a safe location open to atmosphere.

- The ELE21 purges twice during ramp-up, each of the purges occurring at 5 barg internal pressure. The ELE21 additionally purges every 12 hours (the 8 barg version Electrolyser purges every 3 hours), when User ramps the system down, or when – for any given reason – the electrolyser needs to go into a safe state. The output from this port is not constant; it only occurs during production when any of the conditions above are met. During the purge, all the pressurised H_2 and water accumulated in the ELE21 internal water trap are expelled suddenly. A transient high-pressure flow is expected, whose characteristics are dependent on the User piping side of this interface.
- The User should connect piping with compatible material – i-e. 316L Stainless Steel.

7.5 FILL/DRAIN

This port is used only during the first refilling of electrolyte solution or during maintenance. This port is also used during draining of the ELE21 during maintenance. The connector needed to plug into this interface is provided by Enapter.

Name	FILL/DRAIN
Fitting Type	10 mm CPC female coupling
Fitting Material	POM (Polyoxymethylene)
Fluid	Aqueous KOH solution (1-2% concentration)
Flowrate	0-1.6 L/min.
Pressure	Atmospheric
Temperature	6-55°C

- Enapter provides the male coupling and piping to connect to this port with the Electrolyte for first refilling and for draining. Any plastic piping with an outside diameter of 10 mm is compatible with the interface fitting. Particular care should be taken in selecting material resistant to KOH.

7.6 POWER

This inlet port is needed to provide power to the ELE21. The connector needed to plug into this interface is provided by Enapter.

Name	POWER
Fitting Type	PCB 3-pin 7,62 mm pitch female connector
Fitting Material	PA (polyamide)
Fluid	Electric current
Current	0-13 A
Voltage	200-240 V_{AC}
Frequency	50/60 Hz

- Enapter provides the male coupling to connect to this port. Conductors with a cross-section up to 4 mm^2 are compatible with the Enapter provided male coupling.

7.7 DRY CON.

This plug is used for operating the integrated dry contact function. The main contact is on the bottom and the repeater is on top. The connectors needed to plug into this interface are provided by Enapter.

Name	DRY CON.
Fitting Type	PCB 4-pin 5,08 mm pitch female connector
Fitting Material	PA (polyamide)
Fluid	Electricity
Voltage	0-5 V_{DC}

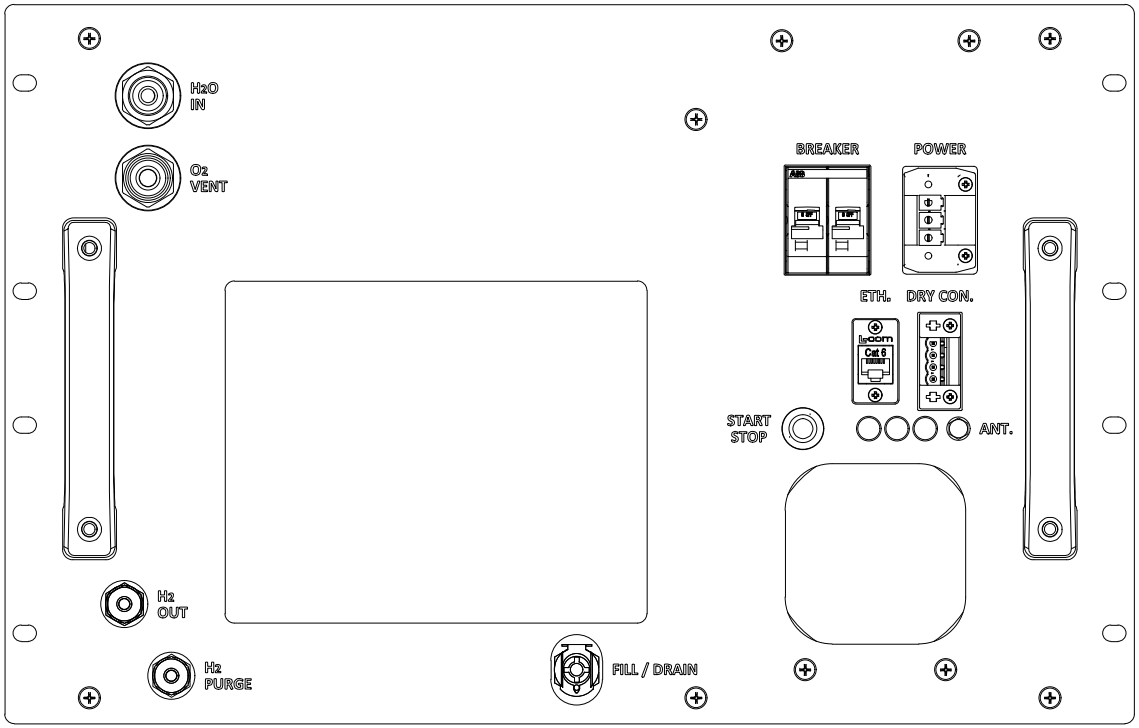
- Enapter provides the male couplings to connect to this port. Conductors with a cross-section up to 2,5 mm^2 are compatible with the Enapter provided male couplings.

7.8 ETH

This inlet port allows the User access to the ELE21 Modbus control and monitoring.

Name	ETH
Fitting Type	Female Ethernet port

8 APPENDIX: INTERFACE DRAWING ELE21-DRW-INT02



ELECTROLYSER 2.1 INTERFACE LIST

#	NAME	TYPE	MATERIAL	FLUID	FLOWRATE	PRESSURE	TEMPERATURE
A	H_2O IN	8 mm OD Pushfit female fitting	LLDPE	Demineralised water	0-4 L/min	1-4 barg	6-55°C
B	O_2 Vent	10 mm OD Pushfit female fitting	LLDPE	O_2 + H_2O vapour + H_2 (<2%)	0-250 NL/h	0-0,5 barg	20-55°C
C	H_2 OUT	¼" double ferrule female compression fitting	316L Stainless Steel	H_2	0-500 NL/h	0-35 barg (35 barg version); 0-8 barg (8 barg version)	20-55°C
D	H_2 PURGE	¼" double ferrule female compression fitting	316L Stainless Steel	H_2 + liquid H_2O	0-35 L/s (transient)	0-35 bar (transient) (35 barg version); 0-8 barg (transient) (8 barg version)	20-55°C
E	FILL / DRAIN	10 mm CPC female coupling	POM (Polyoxymethylene)	Aqueous KOH solution (1-2%)	0-1,62 L/min	Atmospheric	6-55°C
F	POWER	PCB 3-pin 7.62mm pitch female connector	PA (Polyamide)	Electric current	0-13 A / 200-240 V_{AC} / 50-60 Hz		
G	DRY CON.	PCB 4-pin 5.08mm pitch female connector	PA (Polyamide)	/	/	/	/
H	ETH	Ethernet port	/	/	/	/	/

REV	DATE	ALTERATION
00	03/02/2021	FIRST RELEASE
01	13/05/2021	8 BARG VERSION SPECIFICATIONS ADDED
02	26/07/2021	H2O IN - DESCRIPTION
03	15/11/2021	H2O IN - PRESSURE

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CHECKED	C. Poggesi
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Enapter

FIRST ANGLE