ELECTROLYSER 2.1 LC BATTERY LIMITS

DOCUMENT N°: ELE21-BLI-INTW2

Rev.	Status	Date	Revision memo	Issued by	Checked by	Approved by
04	IFP	26/07/2021	H2O IN description	F. Bucaccio	C. Poggesi	M. Söhner
03	IFP	24/6/2021	Filter on water inlet	E. van der Put	M. Contreras	M. Söhner
02	IFP	14/05/2021	Purge Description	F. Bucaccio	C. Poggesi	J.J. Schmidt
01	IFP	13/05/2021	Vent line description / 8barg version included	F. Bucaccio	C. Poggesi	J.J. Schmidt
00	IFP	16/11/2020	First issue	E. van der Put	C. Poggesi M. E. Contreras	J. J. Schmidt.

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1 PURPOSE

The scope of this document is to define and describe the battery limits of the Electrolyser 2.1 Liquid Cooled. 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

ELE2105XXA2LSVXX only.

3 DEFINITIONS AND ABBREVIATIONS

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

4 REFERENCE DOCUMENTS

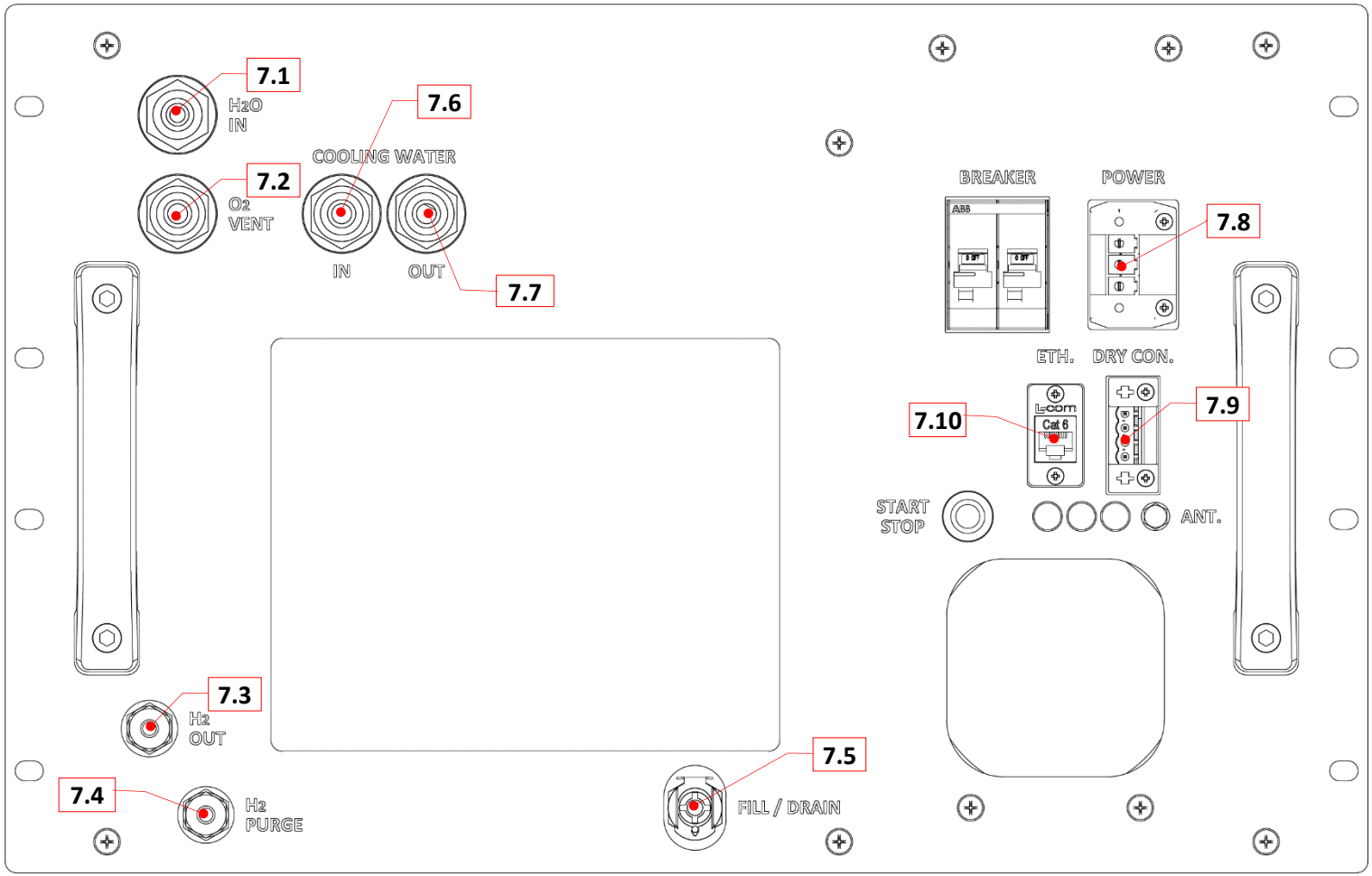
Code	Name
ELE21-PID-W0001	Electrolyser 2.1 LC P&ID
ELE21-DRW-INTW1	Electrolyser 2.1 LC Interfaces
ELE21-MAN-W0001	Electrolyser 2.1 LC User Manual

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 LC physical interfaces. All interfaces are located on the front panel.



7 INTERFACE SPECIFICATIONS

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

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	0.5-4 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 LC. If the pressure is too low, refilling does not start. If pressure drops below 0.5 barg during refilling, the ELE21 LC issues a warning message.
- When water with a temperature lower than 6°C is detected, an error on the ELE21 LC is triggered. Water with a temperature higher than 58°C also triggers an error on the ELE21 LC and can damage the ELE21 LC.
- The input water must, at all times, have a conductivity lower than 20 µS/cm and not contain any particles. 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 are part of the effluent. It also serves as an overfill port if the ELE21 LC 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 LC triggers if any overpressure is found on the line. Pressures exceeding 0,5 barg can damage the ELE21 LC.
- The flow rate is proportional to the ELE21 LC H_2 production rate – i.e., at 60% of production capacity, 60% 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. The 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 LC safety measures are dependent on it. The port should be connected to a safe location open to atmosphere.

- The ELE21 LC purges twice during ramp-up, each of the purges occurring at 5 barg internal pressure. The ELE21 LC 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 LC 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 LC 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 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 Cooling IN

This inlet port is used for the cooling of the electrolyte. At the back of this port is a solenoid valve that opens when cooling is needed.

Name	Cooling IN
Fitting Type	10 mm OD Pushfit female fitting
Fitting Material	LLDPE
Fluid	Water or another cooling agent, free of particles
Flowrate	0-7 L/min (intermittent)
Pressure	0.5-7 barg
Temperature	6-45°C

- Water or another cooling agent is required to be supplied to the device by a pump. The cooling agent needs to be compatible with 1.4404 and 1.4301 stainless steel and LLDPE.
- Ensure the pressure of the cooling agent does not exceed 7 barg, this will damage the electrolyser.

- The needed instantaneous flow rate of the cooling agent depends on the inlet temperature and varies between 1 L/min and 7 L/min at a maximum inlet temperature of 45 °C. Lower inlet temperatures are acceptable. Overall allowable inlet temperature for the cooling agent is 6-45 °C.
- If not enough cooling water is supplied, the electrolyser will go into error mode.
- Make sure the cooling agent is free of particles as they can damage the electrolyser by mounting the filter supplied by Enapter on the cooling inlet.

7.7 Cooling OUT

This outlet port is used for the cooling of the electrolyte.

Name	Cooling OUT
Fitting Type	10 mm OD Pushfit female fitting
Fitting Material	LLDPE
Fluid	Water or another cooling agent
Flowrate	0-7 L/min (intermittent)
Pressure	0.5-7 barg
Temperature	6-55°C (during operation)

- The hot cooling agent needs to be piped to a buffer tank and heat exchanger to cool it down before circulating it back to the Cooling In port.

7.8 POWER

This inlet port is needed to provide power to the ELE21 LC. 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	220-240 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.

7.9 DRY CON.

This plug is used for operating the integrated dry contact function. Themain contactison 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}

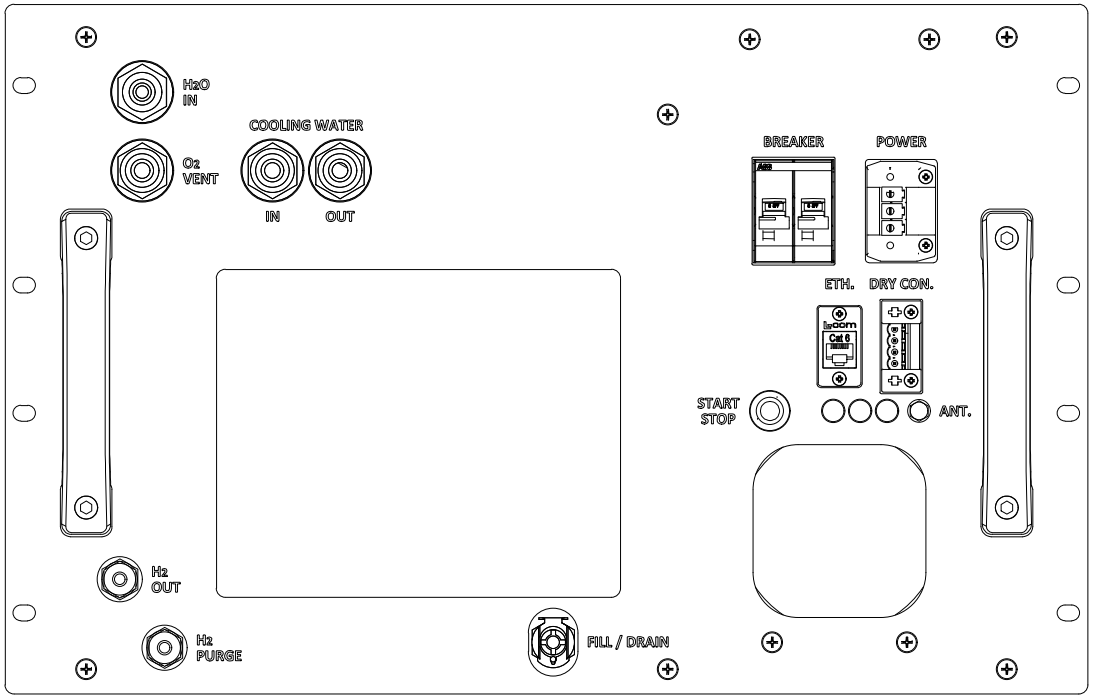
- Enapter provides the male couplings to connect to this port. Conductors with a cross-section up to 2,5 mm^2 are compatible with the Enapter provided male couplings.

7.10 ETH

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

Name	ETH
Fitting Type	Female Ethernet port

8 APPENDIX: INTERFACE DRAWING ELE21-DRW-INT02



ELECTROLYSER LC 2.1 INTERFACE LIST

#	NAME	TYPE	MATERIAL	FLUID	FLOWRATE	PRESSURE	TEMPERATURE	CURRENT and VOLTAGE
A	H2O IN	8 mm OD Pushfit female fitting	LLDPE	Demineralised water	0-4 L/min	0.5-4 barg	6-55°C	/
B	O2 VENT	10 mm OD Pushfit female fitting	LLDPE	O2 + H2O vapour + H2 (<2%)	0-250 NL/h	0-0.5 barg	20-55 °C	/
C	H2 OUT	1/4" double ferrule female compression fitting	316L Stainless Steel	H2	0-500 NL/h	0-35 barg	20-55 °C	/
D	H2 PURGE	1/4" double ferrule female compression fitting	316L Stainless Steel	H2 + liquid H2O	0-35 L/s (transient)	0-35 barg (transient)	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	COOLING IN	10 mm OD Pushfit female fitting	LLDPE	Water or other cooling agent	0-7 L/min (intermittent)	0.5-7 barg (intermittent)	6-46 °C	/
G	COOLING OUT	10 mm OD Pushfit female fitting	LLDPE	Water or other cooling agent	0-7 L/min (intermittent)	0.5-7 barg (intermittent)	6-55 °C (during operation)	/
H	POWER	PCB 3-pin 7.62mm pitch female connector	PA (Polyamide)	Current	/	/	/	0-13 A / 200-240 VAC / 50-60 Hz
I	DRY CON.	PCB 4-pin 5.08mm pitch female connector	PA (Polyamide)	Electricity	/	/	/	0-5 VDC
J	ETH.	Ethernet port	/	/	/	/	/	/

REV	DATE	ALTERATION
00	16/11/2020	FIRST RELEASE
01	26/07/20210	H2O IN - DESCRIPTION

DESIGN BY	K. Loudon
CHECKED	E. van der Put
APPROVED	J. Schmidt
DISCIPLINE: PJM	DATE: 26/07/2021
DRAWING STATUS: IFI	SHEET: 1 of 1 — SCALE: N/A
FIRST ANGLE	DRAWING TITLE: EL 2.1 LC INTERFACES
Enapter	PART N° ELE21-DRW-INTW1_REV01 — A3