

PEM-Single Cell Test Bench

L.I.S.A

**Simultaneously long-term testing for
up to 4 single cells**

Test bench for multiple single cells

Overview

The innovative L.I.S.A. (Longterm Investigation System for Electrolysis Applications) test bench enables the simultaneous testing of up to four PEM single cells under precisely controlled operation conditions. This specialized design effectively mitigates the influence of Balance of Plant (BoP) factors on measurement results, ensuring high data integrity and reproducibility. The system is specifically engineered for long-term endurance testing exceeding 1,000 hours.

To maximize throughput and flexibility, all four Units Under Tests (UUTs) can be operated independently. Key controllable parameters include precise regulation of water flow rates (up to 0.7 l/min per cell) and temperatures (heating/cooling) up to 80 °C per cell on the anode side and controlled differential pressure of up to 50 bar(g) on the cathode side. Each UUT is equipped with an individual power source supporting current densities of up to 8 A/cm² for active cell areas of up to 25 cm².

L.I.S.A. supports a wide range of sophisticated diagnostic protocols, including polarization curves for performance mapping, Accelerated Stress Tests (ASTs) for degradation analysis, H₂-in-O₂ measurement for H₂ crossover analysis and sampling possibilities for water and gas analysis. The test bench is fully integrated into the HyCentA testing infrastructure, featuring all necessary interfaces for advanced, automated testing procedures in a professional research environment.

Description



Figure 1: PEM Single cell testbench L.I.S.A integrated into the state-of-the-art testing infrastructure at HyCentA

Features of the test bench:

- Non-stop operation 24/7
- Fully automated test sequences
- Flexible water and gas sample ports on the anode and cathode side per UUT
- Operation current or voltage-controlled individual per UUT
- Polarization curves under variant conditions
- Activation according to customer specifications
- Controlled nitrogen flushing after operation
- Investigation of degradation mechanisms using endurance runs and ASTs
- Long term testing (>1,000 hours) of multiple UUTs simultaneously
- H₂-in-O₂ measurement for H₂ crossover analysis (on request)

Boundaries

All four electrolysis cells can be operated on the test bench under following conditions:

Description	Value	Unit
Electrical data		
Power	0 ... 500	W
Current	0 ... 200	A
Voltage	0 ... 18	V
Cell area and number of cells		
Number of testing specimen possible	4	UUT
Cell area per UUT	up to 25	cm ²
Number of cells per UUT	1 (more on request)	cells
Pressure		
Anode	open to atmosphere	[-]
Cathode	1 ... 50	bar(g)
Temperature	40 ... 80	°C

Anode feed water cooling can be implemented independently for each UUT, in accordance with specific testing protocols. To ensure optimal purity throughout the process, the water quality is continuously monitored.

On the cathode side, three distinct paths are available for UUT integration based on customer specifications. Multiple UUTs can be operated within a single cathode path. Furthermore, differential pressure operation can be achieved using both continuous and discontinuous pressurized paths, with pressure cycles managed via programmable back-pressure regulators. A third path is specifically designed for atmospheric pressure operation. The configuration on the cathodic side in Figure 2 is provided as an example and can be adapted to specific testing plans.

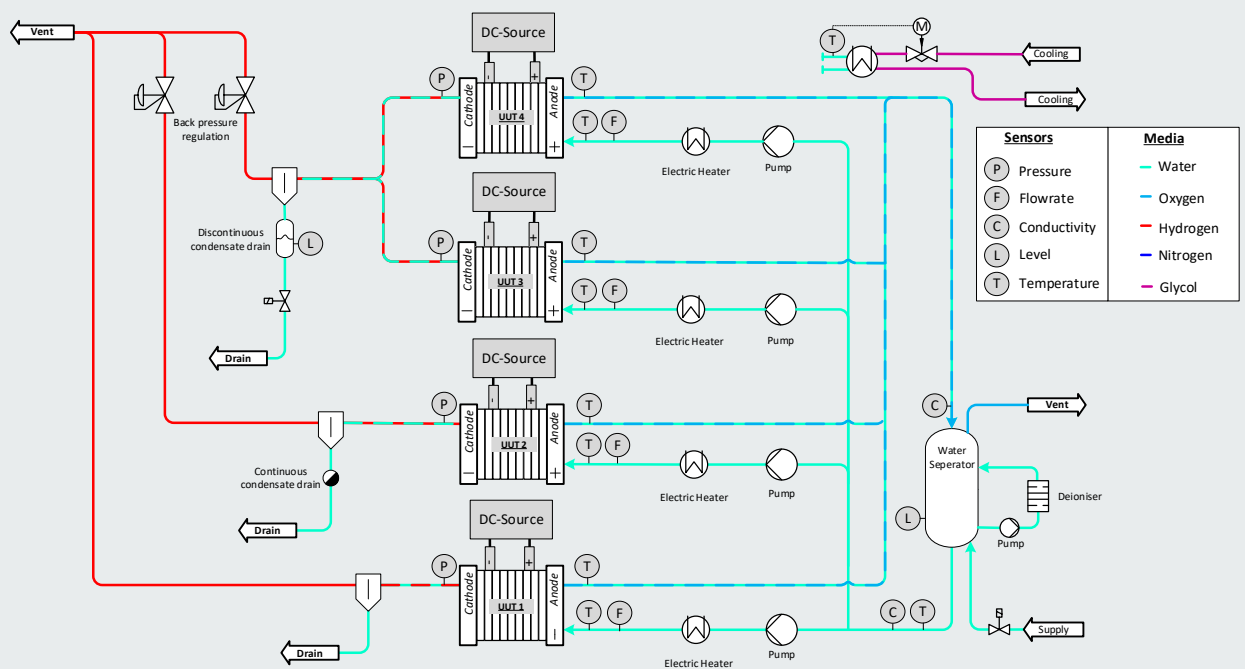


Figure 2: Simplified scheme of the test bench