HORIBA

PEM FUEL CELL TESTING EQUIPMENT

EVALUATOR LT-SERIES

EVALUATOR LT TEST STATIONS

HORIBA FuelCon's Evaluator LT test stations are proven solutions for our customers´ specific requirements: long-term studies, performance tests, system qualification and material characterization. Our product line ranges from test and diagnostic solutions for PEM single cells, components, stacks and systems to manufacturing equipment of PEM stacks.

For each product development stage from basic cell research to examine catalysts, membranes, the gas diffusion or the cell design in total there is a suitable test station. The testing options include proof of concept evaluation in regards to performance, efficiency and durability, up to the prototype analysis for behavior studies under different and dynamic conditions and at the end the fuel cell system testing for monitoring the functionality of all components together. Different test station classes guarantee an aligned design with various test item sizes ranging from 50 W to 250+ kW.

Thanks to the flexibility in the design, the test stations find their home at many use cases. They are installed at R&D institutes and universities, labs of OEMs and tier-one suppliers, test service providers and production lines for stacks. In addition, they are practical for all experience levels of users and the complexity of the testing task. Testing fuel cells for stationary or mobile applications is the key purpose of the test systems.

The Evaluator LT-Series can be used for simple load cycles tests, electrical characterisations, like polarisation curves, but also for more advanced procedures like impedance spectroscopy, accelerated stress tests, driving cycles, endurance testing and environmental simulations in combination with climate chambers and shakers. To make this variety of applications possible, all test stations are equipped with a humidification system, electronic flow control, temperature and pressure control, nitrogen purge and electronic load management.

TECHNICAL FEATURES AND YOUR BENEFITS

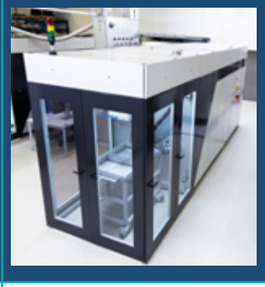
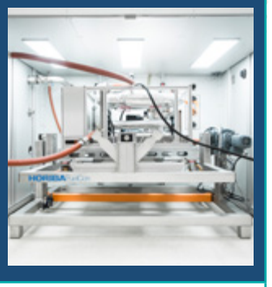
- High quality materials and components
  - **High reliability with approved test station components and long operating time of our test stations**
  - **Low maintenance and calibration cost**

- High control and measurement accuracies
  - **Traceability of data**
  - **Fully data protection**
- Powerful automation software HORIBA TestWork
  - **Fully automated, unattended operation of the test station with full flexibility in the test program creation**
- Synchronized time stamps for all data
  - **Easy cause-effect analysis after tests**

- Multi-level event and alarm system with a safety PLC
  - **Separate, independent safety controller to maximize the safety for the test item, the operators and the test station itself**
- Design according to risk assessment ISO 12100 and CE confomity marking
  - **Minimized risk for normal operation**

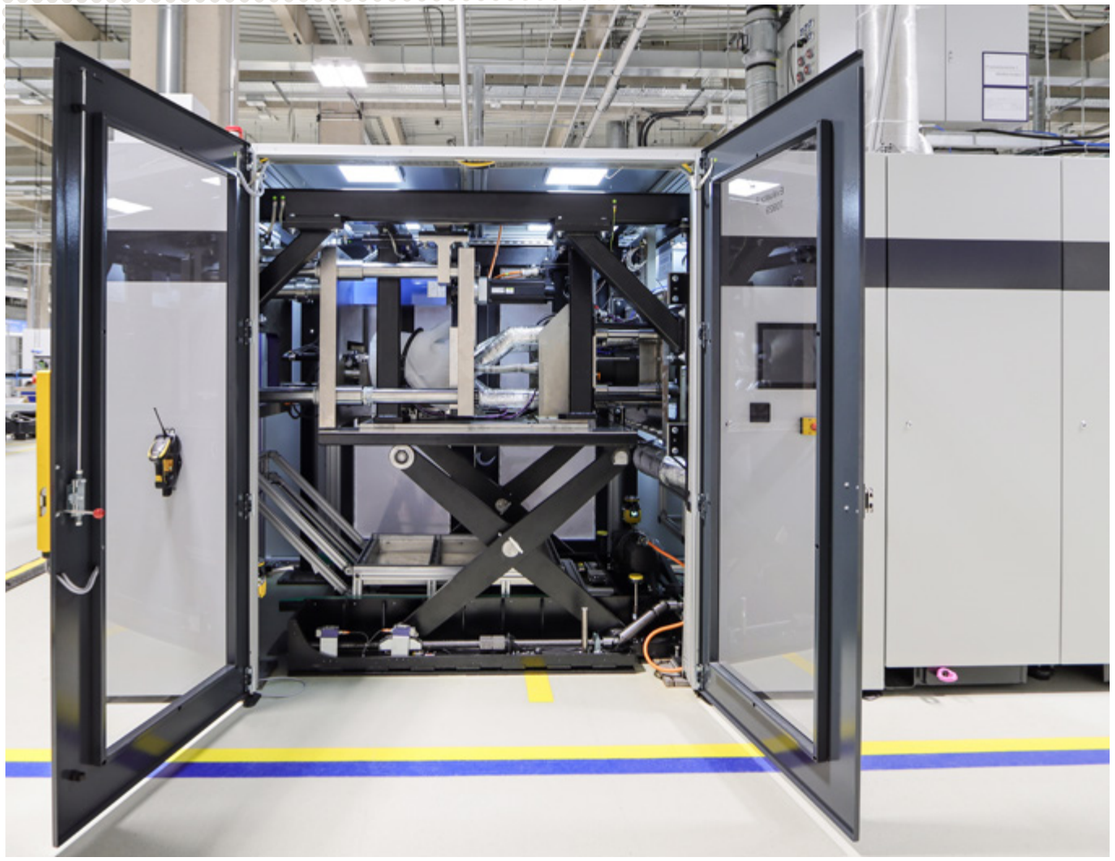
- Climatic chambers and shakers integrated into the test station layout as well as safety concept and data acquisition system
  - **Expand test capabilities to environmental simulation**
- Control of all devices with one automation system
  - **Easy operation of complete test station**

GENERAL SPECIFICATIONS

Test Station Class	Evaluator C10-LT	Evaluator C50-LT	Evaluator C1000-LT	Evaluator S5-LT	Evaluator S25-LT	Evaluator S100-LT	Evaluator S200-LT	Evaluator SX200-LT
								
Dimensions WxDxH [m]	1.1 x 0.8 x 1.6	1.3 x 0.8 x 1.9	2.2 x 1.2 x 2.2	2.4 x 1.6 x 2.4	6.0 x 1.6 x 2.4	7.0 x 2.0 x 2.4	7.2 x 4.0 x 2.4	Up to 8.0 x 2.0 x 2.4
Current	Up to 100 A	Up to 250 A	Up to 1,000 A	Up to 1,000 A	Up to 1,000 A	Up to 1,000 A	Up to 1,000 A	Up to 1,000 A
Measurement Accuracy Current	±0.05 % FS + 0.08 % actual of value*				±0.03 % FS + 0.015 % actual of value*			
Voltage	Up to 6 V	Up to 6 V	Up to 35 V	Up to 100 V	Up to 600 V	Up to 600 V	Up to 1,000 V	Up to 1,000 V
Measurement Accuracy Voltage	±0.05 % FS + 0.08 % actual of value*				±0.03 % FS + 0.015 % actual of value*			
Power	Up to 100 W	Up to 500 W	Up to 2 kW	Up to 10 kW	Up to 50 kW	Up to 100 kW	Up to 250 kW	Up to 250+ kW
Anode Flow [Nl/min]	Up to 2	Up to 5	Up to 40	Up to 200	Up to 800	Up to 2,000	Up to 4,500	Up to 4,000
Control Accuracy	±0.1 % FS ±0.5 % of actual value*					±1 % FS (Optional: ±0.8 % FS + 0.2 % of actual value*)		
Cathode Flow [Nl/min]	Up to 5	Up to 20	Up to 100	Up to 600	Up to 2,000	Up to 4,000	Up to 13,000	Up to 10,000
Control Accuracy	±0.1 % FS ±0.5 % of actual value*					±1 % FS (Optional: ±0.8 % FS + 0.2 % of actual value*)		
Operation Pressure	Up to 5 bara on Anode & Cathode Pressure sensor accuracy ±0.25 % FS							
Gas Temperature & Dew Point	Maximum gas temperature 100 °C (Optional: 130 °C) Maximum dew point of 90 °C							
Conditioning DUT	Heating plates/ air cooling		Liquid cooling loop Maximum 90 °C with ±1 K Control accuracy; maximum 5 bara with ±0.25 % FS measurement accuracy					

*All values are subject to change without further notice

END-OF-LINE TEST SYSTEMS



Besides test equipment for research and development or validation, the requirements for production tests are more special. Our Evaluator End-of-Line system is dedicated to production testing for fuel cells in a power range of up to 250+ kW. The test stations are designed to perform fast quality assurance testing of cells, like OCV measurement, leakage test, thermal or electrochemical cycles, as well as the initial conditioning period of MEAs and stacks.

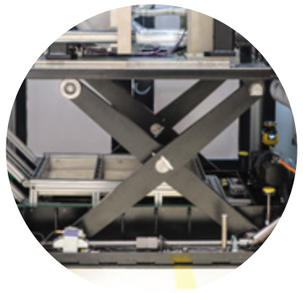
Trolley systems provide easy handling of any transport of stacks including self-coupling or quick connection systems for the trolleys.

The cost-efficient design can contain conveyor belts with automated docking and undocking of fuel cell systems. To reduce testing times of stacks at the EOL station an automated external coolant filling and draining, or leakage testing station can be provided.

As option, the system can be equipped with industrial PC or operator panel. The station is controlled via production software for simplified start and stop of procedures.

Furthermore, the EOL system allows automated display of pass/fail criteria and read/write access to customer production database. High safety standards with a fail-safe PLC control ensures maximum performance under safe conditions.

TECHNICAL FEATURES AND YOUR BENEFITS



- Integrated test item cabin in different configurations and concept
  - **Suitable solutions for different test item sizes and feeding concepts**
- High speed cell voltage monitor and high frequency resistance logger
  - **Fast measurement concepts to reduce testing time**
- Fully automated contacting system with multi-coupling
  - **Increased productivity by reducing preparation times and manual labour**
  - **Minimize errors and maximize safety**
- Cooling loop with integrated heating
  - **Fast conditioning of the test item with preheating and bypass functionality**
- Automated test item handling inside of the test station
- Extensive test programming with HORIBA TestWork
  - **Full control over the test station to create simple and customized scripts or sequences to accommodate specific testing demands**
- Data Interface to manufacturing execution systems
  - **Data exchange enables the integration in the central MES for monitoring and control**
- Full ATEX exhaust side
  - **Safe operation of the test station even in the event of a defect on the test item**

OUR BENEFITS AT A GLANCE

HORIBA FuelCon is one of the world´s leading manufacturers of innovative testing and manufacturing systems for fuel cells and electrolyzers. Over 20 years of experience in this field of work built our competence and knowledge, which we put to use in every test system we design. This allows us to give you standardized solutions for your general testing demands, as well as fully customized ones for your specific testing requirements.

We always focus on the reliability and quality of our products and on proximity to our customers. To meet even the most complex requirements, we use intelligent engineering, a maximum value chain in our company and the highest safety standards in all development steps. With years of experience in the automation of test and production processes, we are your competent partner for the testing, qualification and validation of your future developments.

As part of the HORIBA Group with over 8,000 employees and 50 companies around the globe, you can rely on a strong local distribution and service network. The broad expertise of HORIBA in different measurement technologies gives us the opportunity to offer solutions beyond the sole fuel cell or electrolyzer testing. This includes gas & material analysis devices, powertrain & vehicle test beds and large-scale test field automation software.

HORIBA

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