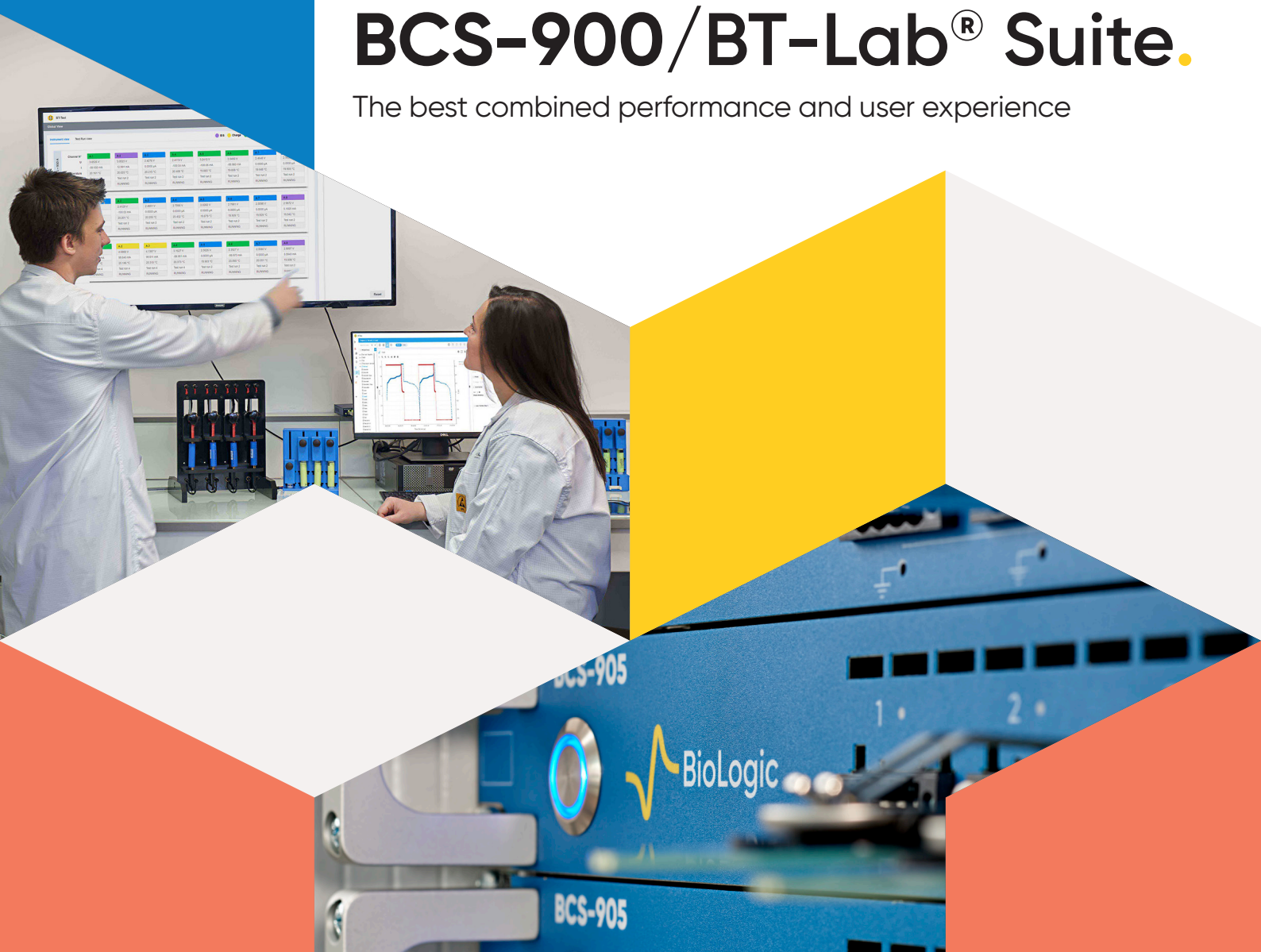
BioLogic

BATTERY CYCLERS

BCS-900/BT-Lab® Suite.

The best combined performance and user experience

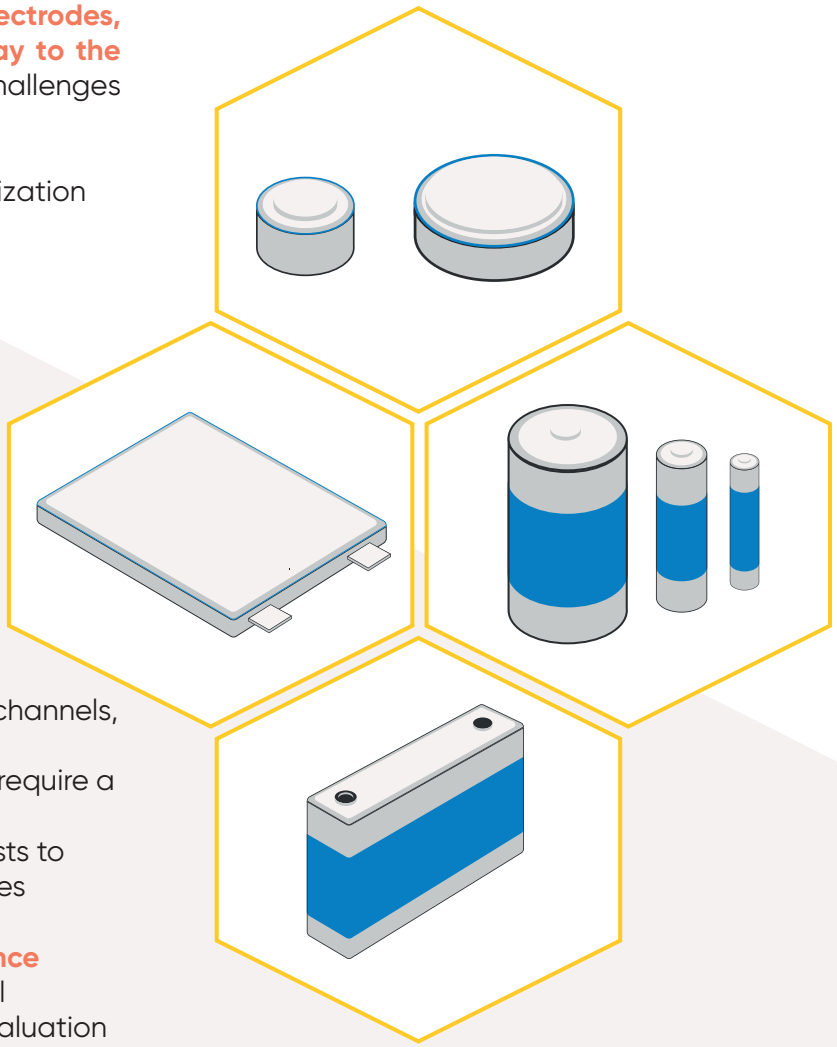


Charge ahead with battery innovation

From research to industry

Throughout the **full battery value** chain every single component must be **thoroughly tested: electrodes, binder, separator, electrolyte, all the way to the commercial cell**, and there are unique challenges at every step:

- Materials & components research
- Research cell performance & characterization
- Manufacturing process optimization
- Commercial cell validation & ageing
- Screening & benchmarking for modules
- Integration & second life evaluation



In a fast-paced research field, demands require instruments to keep up with innovation challenges:

- Cycling tests are lengthy, require many channels, and therefore must have **high reliability**
- Battery tests represent high stakes and require a high safety level
- **Novel chemistries** push research scientists to **adapt testing equipment** and techniques

Efficiency is key: **Electrochemical Impedance Spectroscopy (EIS)**, in addition to classical techniques, allows rapid and accurate evaluation of key cell criteria during its life cycle.

40 years of experience

For almost 40 years BioLogic has dedicated itself to the research and development of electrochemical instruments for research in energy storage. This dedication has earned BioLogic a reputation as **a global leader in the production of battery testing and analysis instruments.**

Why BioLogic for cycling?

Unique benefits for battery cell tests

Run reliable & safe tests

Battery cycling tests are long term and high stakes, and the BCS-900 series system architecture is specifically designed to meet that challenge with:

- A **dedicated and embedded operating system: not PC dependant.**
- Local storage redundancy.
- Real time **channel status updates** with the Global View.
- **Accessibility** either **remotely or on-site** at **any time**.
- Stop the test automatically with **safety limits** or manually with the BCS-Stop Button.

Adapt to evolving needs

Because battery technologies and testing needs are constantly evolving, the BCS-900 multi-channel battery cyclers allow increased flexibility and modularity.

- Autonomously **add more channels** to existing systems any time: hot connection with no impact on tests currently running.
- **Mixing BCS-900 modules** achieves measurement from a few µA to 120 A.
- BT-Lab® software suite is **continuously upgraded** to ensure the best possible adaptability.

Comprehensive from test to analysis

Starting with a turnkey installation, the BCS-900 series has an **application-oriented design** that is based on years of experience and users' feedback, allowing users to:

- **Automate test profiles** and test variables with flexible test plan settings.
- **Monitor graph data in real time** during tests.
- Automatically **generate and display graphs**.
- Analyze multiple sets of data simultaneously.

Last but not least, with fully **integrated EIS**, operation is seamless from the software interface, for an all-in-one system.

Control & measure with precision

The BCS-900 series integrates technology and expertise to ensure needs are met: offering precision, accuracy and resolution at its best.

- **1 ms** continuous sampling and **process rate**
- **5 current ranges** adapt to various battery capacities and C-rates - maintaining the highest level of accuracy,
- Smooth CC-CV switch
- **Low standard deviations** between channels
- Oversampling allows averaging and **very low signal to noise ratio**

BT-Lab® Suite: from reliable tests ...

BT-Test™

Get the best performance by utilizing all features BT-Test™ offers in a battery application-oriented software.

- Modern interface with user-friendly grid
- Embedded software operation
- Global View to monitor all channels
- Remote access for easy data management
- Redundant storage for data safety

Test Run - Check ongoing tests

A Monitoring window is available to get a full real time overview of any ongoing test by:

- Displaying **live data**.
- Following your **channel status** on the DUT Run monitoring table.
- Providing the **activity log**.
- **Modifying** Test Plans **on-the-fly**.

Evolutive test plans with dynamic variables

- **Task variables**: available at the end of each step will feed and update test plans in real time - based on measured and processed values (U, I, t, charge, energy...).
- **User variables**: custom variables - based on user defined formulas.

BCS-900

Get the best modularity by mixing and matching modules.

Three instruments...

- BCS-905, BCS-910, BCS-915
- 8-channel modules
- 150 mA, 1.5 A, 15 A
- Single cell tests up to 10 V
- 40 µV measurement resolution (18 bit)
- Extendable current control up to 120 A
- 5 current ranges on each module
- Native EIS up to 10 kHz
- Fast sampling rate up to 1 ms

... In a system with embedded BT-Test™ software

- 4 rack sizes (6U, 12U 24U, & 38U)
- Mix and match BCS-900 series
- Instrument with local processing
- Independent data storage within the system
- Compatible battery holders

... to efficient analysis

BT-Analysis™

Get the best efficiency through custom and automated batch data processing and display.

- Remote **access to database** for live data **import**
- **Online and offline** data access
- User-friendly and intuitive navigation
- Customizable graphical and tabular representation
- Multiple **application-oriented** data processing and statistic tools (see specifications)
- Battery plot comparisons

Recipes and Graphical tools:

- Summary table: process values by cycle, loop or step
- Statistics: graphical comparison tool on several DUT (Device Under Test)
- Processed data: graphical representation of values (U_{mean}, Q_{charge}, $Q_{discharge}$) vs. cycle or loop time
- Automated batch data processing

Native EIS

EIS is native and **fully integrated into BCS cyclers**.

- Seamless operation: no third-party instrument necessary
- **Data fit** to a predefined circuit thanks to Zfit analysis

A comprehensive solution for battery cycling

Specifications



	BCS-905	BCS-910	BCS-915
Channels	8		
Voltage			
Range	0 V to 10 V	0 V to 10 V	0 V to 9 V
Control resolution	150 µV		
Measurement resolution	40 µV (18 bit)		
Accuracy	<±0.01% of value ±0.3 mV		
Slew rate	150 kV/s	150 kV/s	3 kV/s
Current			
Max (continuous) per channel	±150 mA	±1.5 A	±15 A
Ranges	5: 100 mA down to 10 µA	5: 1 A down to 0.1 mA	5: 10 A down to 1 mA
Control resolution	Down to 0.8 nA	Down to 8 nA	Down to 80 nA
Measurement resolution	Down to 0.2 nA (18 bit)	Down to 2 nA (18 bit)	Down to 20 nA (18 bit)
Accuracy	< 0.05% of value ±0.015% of FSR*	< 0.05% of value ±0.015% of FSR* < 0.1% of value ±0.015% of FSR* (1 A range)	< 0.05% of value ±0.015% of FSR* < 0.1% of value ±0.015% of FSR* (1 A range) < 0.3% of value ±0.04% of FSR* (10 A range)
Parallel ability	No	No	Yes, Up to ±120 A with 8 channels
EIS			
Built-in	Optional on each module (multiplexed across 8 channels)		
Range	10 kHz - 10 mHz		
Measurement			
Acquisition time	1 ms		
Time base	1 ms		
Additional measurement			
Thermocouple	NA	K Type on each channel-25 °C +200 °C with accuracy of ±2 °C	
Cell connection			
	4 terminal leads + Guard	4 terminal leads + Guard	4 terminal leads
General			
Height	1U	2U	4U
Weight	6.5 kg	11 kg	24.5 kg
Power consumption	60 W	220 W	1700 W

* FSR: Full Scale Range / Pictures and specifications subject to change. / Specifications given with 2.5 m cell cable.

6U Cabinet

12U Cabinet

24U Cabinet

Software	BT-Lab® Suite
General	• Grid for programming, pop-up global view window to visualize all channels • Powerful monitoring system: DUT status, activity log, grid and graph (BT-Test™) • Easy data access and data management • Modify on-the-fly settings
Tasks	REST, CC, CV, AUP, CALCULATE, CC_CV, CLD, CPW, CS, DCIR, G-ACIR, GEIS, PEIS, LOOP, VS
Task Parameters	• Up to 6 task limits among: t, U, ΔU, I, |I|, Q, Q_{charge}, $Q_{discharge}$, P, |P|, E, E_{charge}, $E_{discharge}$ • Up to 3 record conditions among: Δt, |ΔU|, |ΔI|, |ΔQ| • Ranges from 10 µA to 10 A
Safety Limits	U_{min}, U_{max}, $\|I\|_{min}$, $\|I\|_{max}$, $\|Q\|_{min}$, $\|Q\|_{max}$, T_{min}, T_{max}
Grid	Up to 128 steps. Up to 4 Loops: self-contained or nested. Accessible tool bar to edit the steps of the grid. Intelligible task display for control, limits and records
Graph	Accessible toolbar to adjust graph display, application oriented predefined graph representations, easily customizable display of traces, high performance graphics adapted to large volume of data, filters by steps, cycle and/or loop, unlimited number of traces, graphs or tabs (BT-Analysis™)
Cycles	Customizable cycles: Charge - Discharge or Discharge - Charge
Variables	• Creation of user variables to dynamically program Test Plans • Use of task variables and DUT variables
Analyses	Summary tables, statistic tools, automatic tool for analysis and export

38U Cabinet

One battery partner from A to Z

Master the full measurement chain using high quality equipment and accessories

For connecting test cells

A range of durable high quality cell holders with **4-point connections ensure high accuracy measurements**. Available cell holders for coin cell, pouch cell, cylindrical cell and prismatic cell assure users get:

- True cell values.
- More reliable measurements.
- Higher fidelity.
- Easy and quick connections.

Get access to BCS-900 accessories: a one-stop-shop to suit every need.

For tests that require more

BCS-900 series instruments may be complemented with other **high-precision** electrochemical workstations from BioLogic.

Validate material components for cell design with the VMP-3e

- **Wide EIS frequency range** for characterization of insertion processes
- Quality indicators for the best impedance measurements
- Research cell with 3 electrode system
- Measurements down to -10 V

Increase power capabilities with the FlexP for Pack & Stack

- Highly suitable for Redox Flow Batteries and fuel cell stacks
- DC and AC instruments with EIS up to 10 kHz
- **Extended voltage range** up to 60 V

Find out more about EC-Lab: potentiostats built to handle almost any application imaginable.

We serve our customers worldwide through our subsidiaries offices and our extensive distribution network.

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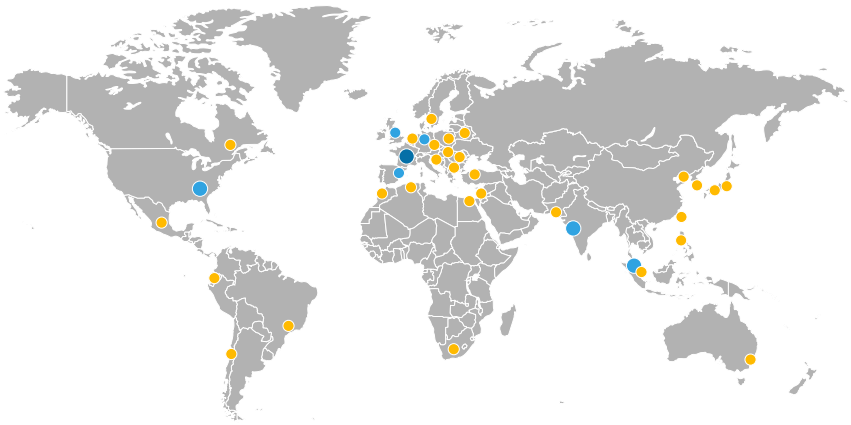

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Brochure BCS-900 released on June 2023, n°2.

Always by your side. Wherever you are.

We here at BioLogic pride ourselves on the quality and robustness of our instruments. However if you, for whatever reason, encounter a problem with your Battery Cycler, our global support network will help find you a solution quickly and effectively.

If you need more information, or perhaps a little inspiration, you can browse our ever-growing support database with hundreds of Learning Center articles, application/technical notes and support videos at www.biologic.net.

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Shaping the future. Together.