Electrochemistry
& Battery Testing instruments.

CATALOG

Potentiostats/Galvanostats
Battery Cyclers
Impedance Analyzer
Scanning Electrochem. Systems

BioLogic

Shaping the future. Together.

A unique and comprehensive range of product

As one of the world's foremost designers and manufacturers of high-performance electrochemical measurement instruments, BioLogic has forged its place as a leader in its field.

A comprehensive product portfolio covers cutting-edge products and accessories across every possible area of electrochemistry including battery, fuel cell/electrolyzer and material testing.

And a culture of innovation, continuous improvement and a commitment to customer satisfaction help BioLogic continue to develop high-performance products that meet the needs of industry and science.

The quality, reliability, and innovation that lies behind BioLogic's product portfolio help shape the future of innovative projects around the world.

Our close proximity with both academic and industrial users helps us understand our clients' needs and develop solutions that truly make a difference – through a marriage of cutting-edge, reliable, high-performance hardware and innovative, user-friendly software.

Our highly qualified support engineers will first work closely with you to fully understand your project and your needs.

Only then will we start to develop a modular, user-friendly, high-performance measurement solution; one supported by a global technical support network.

So, wherever you are and whatever your field of electrochemistry, BioLogic can provide you with the measurement solution you need to take your research to the next level.
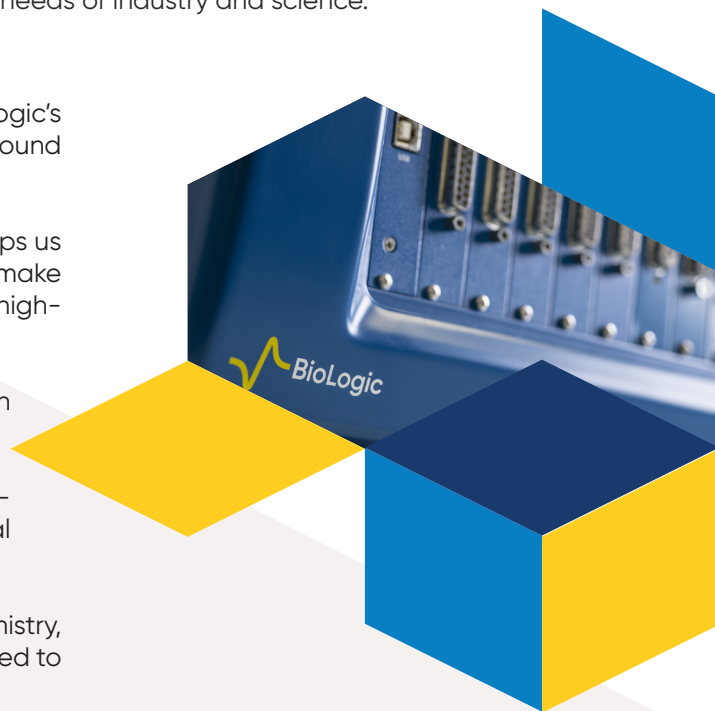
Modular systems

- Single to multichannel potentiostats/galvanostats
- Mix and match battery cycler systems
- High current boosters up to 800 A
- Extended voltage range up to 60 V
- Low current options down to pA
- ARG (Analogic Ramp Generator) for voltage ramp
- Scanning workstations with up to 9 different local techniques (dc-SECM, ac-SECM, LEIS, SKP, SVET...)
- Fully featured impedance analyzer with temperature control

Controlled by a powerful suite of software

- Intuitive user interface
- Pre-set techniques for common applications
- Multiple user systems
- Multi-technique experiment builder
- Control of external devices
- Multiple graph display
- Data analysis & fit
- Safety & experimental limits
- Software calibration
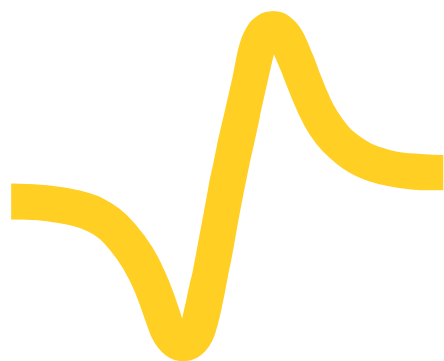
Electrochemical **I**mpedance **S**pectroscopy

A leader in Electrochemical Impedance Spectroscopy (EIS) technologies, BioLogic strives to place EIS within every researcher's reach, by making it available on all of its instruments.

Integrated EIS makes the transition between AC and DC techniques smooth and flawless. Control techniques on AC sine waves can be superimposed on a DC potential or a DC current value. Additional techniques are also available that impose the sine wave on a varied potential (SPEIS, also known as Mott Schottky technique) or a current (SGEIS) values.

Finally, sequenceable EIS techniques can be applied to different defined conditions during the frequency sweep. Accuracy is given by the error observed on the phase of impedance module to magnitude. Most of our potentiostats come with a specification of 1%, 1° accuracy below 500 kHz. With the SP-300 potentiostat providing the highest performance reading 0.3%,0.3°.

Modeling
BioLogic software offers ZFit, a modeling tool for equivalent circuit fitting. Fourteen elements and two minimization algorithms (DownHill Simplex and Levenberg-Marquardt) are available to analyze impedance data.

*BioLogic records contour plot data using standard 1.75 m cables as they are more representative of everyday use (even better results are achievable with shorter cables).
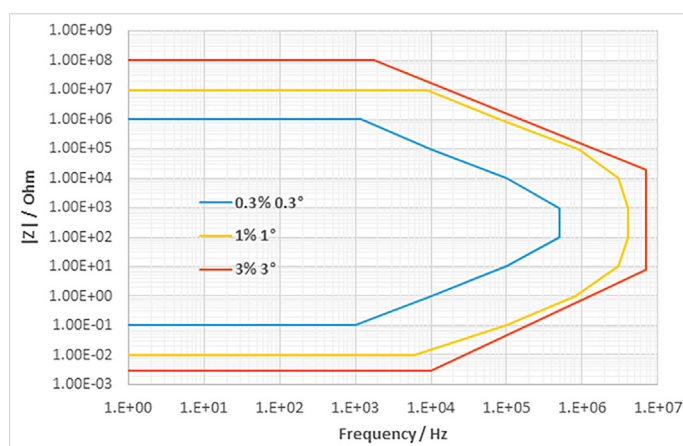
EIS contour plot of SP-300 with standard cable (1.75 m)*

Patented and unique transient state correction technique
- **Drift** correction

Validate EIS measurements quickly and easily with BioLogic EIS QI™:
- **THD**: Total Harmonic Distortion quantifies the linearity of the response
- **NSD**: Non-Stationary Distortion indicates the effect of time-variance and transient regime
- **NSR**: Noise-to-Signal Ratio ensures the signal is large enough compared to measurement noise

Potentiostats/Galvanostats

Battery Test Stations & Cyclers

Impedance Analyzer

Scanning Electrochemical Workstation

Premium Potentiostats / Galvanostats.

Potentiostats with unparalleled quality, precision, performance and speed.

Premium range potentiostats are unparalleled in terms of precision, performance and speed. The range includes single and multi-channel potentiostats, as well as bipotentiostats. BioLogic designed the Premium range for researchers who require the fastest, most precise potentiostats available. With up to 16 channels, this state-of-the-art range of potentiostats boasts the highest specifications available on the market:

- EIS capability 10 µHz to 7 MHz
- Sampling rate as fast as 1 data point every µs
- Up to 13 current ranges:
  - Low current options down to ±100 fA measurement capability
  - Up to 150 A with internal boosters

Single

SP-200

Transportable potentiostat/galvanostat

The **SP-200** is a **500 mA** research grade potentiostat/galvanostat for users who need a budget-friendly solution. With the **80 fA** accuracy ultra-low current option, it is the ideal instrument for applications in electrochemistry, particularly corrosion.
The SP-200 offers a floating mode, analog filtering and a built-in calibration board.

Additionally, the SP-200 can be purchased with a standard DC potentiostat or an EIS capable one. There is also an Ultra Low Current (ULC) option. On-site experiments can easily be performed thanks to its portable design.

Applications

- General electrochemistry
- Sensors
- Corrosion
- Coatings
- Materials
- Batteries
- Electrolysis/anodizing
- Energy

Options

- Ultra Low Current: Accuracy down to ±100 fA on 1 pA range
- Built-in EIS analyzer: up to 7 MHz
- Analog Ramp Generator: 1 MV/s, acquisition 1 μs
- HCV-3048

SP-300

Fast, sensitive, stable and modular

The **SP-300** is a **500 mA to 10 A** state-of-the-art research grade potentiostat/galvanostat with integrated EIS and remarkable specifications such as 7 MHz max EIS frequency, floating mode, analog filtering, built-in calibration board, and stability bandwidths.

The SP-300's modular chassis accepts an optional high current/high-voltage option board.

Alternatively, the SP-300 can accept a second potentiostat board (either standard or EIS) and function as a Bipotentiostat. It is also a multiple user system as each channel board can be used independently by two different researchers.

Applications

- General electrochemistry (RRDE measurements)
- Sensors
- Corrosion
- Electrolysis/anodizing
- Coatings
- Energy

Options

- Ultra Low Current: Accuracy down to ±100 fA on 1 pA range
- Built-in EIS analyzer: up to 7 MHz
- Internal boosters: ±1 A/±48 V, ±2 A/±30 V, ±4 A/[-3;14] V, ±10 A/[-1;6] V
- HCV-3048
- Bi-potentiostat
- Analog Ramp Generator: 1 MV/s, acquisition 1 μs

VSP-300

Small footprint, multichannel potentiostat

The **VSP-300** multichannel potentiostat/galvanostat with integrated EIS is a versatile instrument offering **6 slots.**

Each channel board can accommodate an Ultra Low Current cable and can be associated with one or several booster kits. Up to 4 booster boards can be plugged in parallel in one VSP-300 chassis.

Applications

- Batteries/supercapacitors
- Fuel/photovoltaic cells
- General electrochemistry
- Corrosion
- Sensors
- Materials
- Energy storage

VMP-300

The ultimate multichannel potentiostat

The **VMP-300** is the most modular chassis of the range, offering **16 slots** for potentiostat/galvanostats with integrated EIS boards and/or booster boards.

Slots can be combined according to user needs either to reach high currents, or to drive many measurements at the same time on all channels.

EIS measurements can be added as an option. The built-in EIS has a wide frequency range up to 7 MHz.

Low current sensitivity can be improved using the Ultra Low Current option.

All multichannel potentiostats are multiple user systems. Thanks to the Ethernet LAN connection capability, several computers can be connected to the unit at the same time.

Options

- Ultra Low Current: Accuracy down to ±100 fA on 1 pA range.
- EIS measurement: up to 7 MHz
- Analog Ramp Generator: 1 MV/s, acquisition 1 µs
- Internal boosters:
    - ±1 A/±48 V
    - ±2 A/±30 V
    - ±4 A/[-3;14] V
    - ±10 A/[-1;6] V
- HCV-3048
- Additional potentiostat/galvanostat/EIS

Premium Boosters

HCV-3048

An unparalleled combination of power and speed

The **HCV-3048** is designed ffor battery stack/pack characterizations and electrolyzer/fuel cell testing. The continuous maximum current of **±30 A** for a single unit can be extended up to **±120 A** by connecting four units in parallel. The control voltage range is **0-48 V.**

Impedance spectroscopy (EIS) provides valuable information on energy storage and conversion devices, helping to identify the kinetic properties of multiple processes within the device under test. The HCV-3048 brings unmatched insight to high-power systems.

Features

- Max current ±30 A
- Voltage range 0-48 V
- EIS up to 500 kHz
- Stackable up to ±120 A
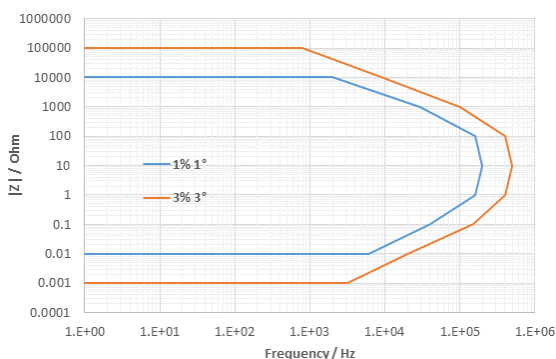
Internal boosters

High current and high-voltage boosters

A range of internal boosters has been designed to increase the current and the voltage specifications of the **SP-300, VSP-300, VMP-300.** Four models are available (see below).

Depending on the instrument chassis, several similar boosters can be connected in parallel to expand the maximum current of the system, up to 150 A.

Configurations
- ±1 A/±48 V
- ±2 A/±30 V
- ±4 A/[-3;14] V
- ±10 A/[-1;6] V

Features

- Autoranging: exploit existing current range plus the new booster range
- EIS capability up to 2 MHz
- Plug-in modules
- Plug-and-play
- 5-lead connection type
- Parallel boosters to increase max current

Essential Potentiostats / Galvanostats.

Powerful, workhorse potentiostats for academia and industry.

BioLogic's Essential range is made up of purpose-built, workhorse potentiostats, designed for researchers who need robust, high-quality electrochemical workstations with standard acquisition times. The series includes single and multi-channel potentiostats, as well as bipotentiostats. With up to 16 channels, BioLogic designed the Essential range to fit almost any need with specifications to match:

- EIS capability 10 µHz to 1 MHz
- Sampling rate of 1 data point every 20 µs
- Up to 6 current ranges:
    - Down to ±20 nA measurement capability
    - Up to 800 A with external boosters

Single

SP-50e

Affordable and easy-to-use

The **SP-50e** is a robust, single-channel, general-purpose electrochemical workstation, perfectly suited to both general electrochemistry research needs as well as teaching.

A ±1 ampere capable range makes the **SP-50e** perfect for energy-based applications including battery, supercapacitor, fuel cell, and electrolysis research.

Powered by EC-Lab®, widely recognized by leading scientists as the benchmark control and analysis software for potentiostat/galvanostats, users are able to exploit a wide range of functions covering not just potentiostat control, but electrochemical analysis as well.

There is no need to split tasks across different software applications. Everything can be found in one place – simplifying your professional life, and saving you precious research time. All this, in a compact potentiostat with a reduced laboratory footprint, opening up space on the laboratory bench.

Applications

- Education/training
- General electrochemistry

Options

- Built-in EIS analyzer: up to 1 MHz
- RDE control kit

SP-150e

A research grade workstation

The **SP-150e** is a potentiostat designed to grow with your research needs. This two-channel, EIS-capable workstation is perfect for a wide range of general electrochemistry applications, but the ±1 A current range makes it especially suitable for energy applications including battery, supercapacitor, fuel cell (RRDE compatible), and electrolysis research.

Should you need more power, this versatile instrument will grow with your research needs. The **SP–150e** is the only ampere workstation to boast high-current capability (800 A with boosters), three EIS quality indicators (THD, NSD, NSR) for EIS validation, and Ethernet compatibility for improved group-working.

It can also be connected to external high current boosters (2, 5, 10, 20, 80 and 100 A) or the FlexP series (see page 14).

Applications

- General electrochemistry
- Sensors
- Corrosion
- Energy sources
- Coatings

Options

- Additional potentiostat/galvanostat/EIS
- Built-in EIS analyzer: up to 1 MHz
- External current boosters: Up to 800 A
- RDE control kit

Multi

VSP-3e

Tailor-made for energy applications

A research-grade multichannel potentiostat/galvanostat, the **VSP-3e** is purpose-built to meet the demands of energy research applications. With space allocated for up to eight channels, the instrument is flexible enough to meet the demands of researchers and R&D specialists alike. And with ±1A (expandable up to 800 A with boosters), Ethernet LAN for improved multiple user/PC connectivity and built-in EIS, the instrument is especially suited to battery research applications.

Energy-specific functionality unique to BioLogic includes:
- Fast CCCV shift (constant current, constant voltage)
- Stack mode (follow individual elements in the pack)
- BCD (Battery capacity determination)
- Automatic plotting for Coulombic efficiency

Options

- Built-in EIS analyzer: up to 1 MHz
- External current boosters: Up to 800 A
- Internal ±4 A booster kit for VSP only
- SAM 50 for stack (50 V) measurement (up to 30 elements with three SAM-50)
- Additional potentiostat/galvanostat/EIS

VMP-3e

16-channel benchmark workstation

A research-grade multichannel potentiostat/galvanostat, the new **VMP-3e**'s modular design, makes it perfect for wide-ranging applications. However, the ability to connect each potentiostat/galvanostat to an external high-current (up to 800 A) booster channel makes it especially suitable for battery research/testing.
A standard voltage range of ±10 V is extendable to -20 V to +20 V.

For high-end EIS measurements, a 1 MHz specification is complemented by BioLogic Quality Indicators, a feature previously only available on BioLogic Premium instruments. Additional features include CE to GND mode, unique to BioLogic, which enables users to choose from independent channel or multi-electrode configurations and LAN connectivity to improve multi-user working.

Applications

- Electroanalytical
- General electrochemistry
- Corrosion
- Sensors
- Energy conversion
- Energy storage
- Batteries
- Coatings

VSP

Affordable, research-grade multichannel potentiostat/galvanostat

The **VSP** is a research-grade potentiostat system in a **5-channel** modular chassis. Options include EIS capability, 4 A current booster and additional potentiostat channels.

The internal 4 A option takes two slots in the VSP chassis and requires a potentiostat board. External boosters from 2 A up to 800 A can be used with each channel in the VSP.

Applications

- Electroanalytical
- General electrochemistry
- Corrosion
- Sensors
- Energy conversion
- Energy storage
- Batteries
- Coatings

How to make reliable EIS measurements with EIS QI™

Three quality indicators are only available in EC-Lab® to ensure the reliability of EIS measurements.

Total Harmonic Distortion (THD)

THD indicates if the amplitude of the current or potential modulation applied to the system is small enough to consider that the system behaves linearly. If it behaves non-linearly, the output signal will contain some harmonics. THD quantifies the non-linearity by evaluating the amplitudes of the N harmonics. THD is expressed as a percentage. Generally, it is considered that a THD below 5% is acceptable. In EC-Lab®, it is calculated on the potential and on the current and over 7 harmonics including the fundamental.

Linearity

$$\text{THD}_N = \frac{1}{|Y_f|}\sqrt{\sum_{k=2}^{N}|Y_k|^2}$$

Non-Stationary Distortion (NSD)

We can distinguish two causes for the non-stationarity of a system: i) the response of the system has not reached its permanent regime; ii) the parameters defining the system are changing with time.
The response of a non-stationary system will contain, in addition to the fundamental frequency, some adjacent frequencies.
NSD is expressed as a percentage and calculated on the potential and on the current.

Stationary

$$\text{NSD}_{\Delta f} = \frac{1}{|Y_f|}\sqrt{|Y_{f-\Delta f}|^2 + |Y_{f+\Delta f}|^2}$$

Noise to Signal Ratio (NSR)

In an ideal EIS measurement, all the signal energy is contained in the fundamental frequency, but because of various factors such as the accuracy and precision of the measuring device or external perturbations, there might be some energy in other frequencies than the fundamental frequency, the harmonics and the adjacent frequencies. In this document, this additional signal is called noise.
It represents all the signals not contained in:
- The fundamental frequency,
- The 7 harmonics used to calculate THD
- The signal at frequencies adjacent to the fundamental frequency used to calculate NSD.

Nose to signal Ratio

$$\text{NSR}_f = \frac{1}{|Y_f|}\sqrt{\sum_{k}|Y_{k\Delta f}|^2}$$

How do I use them?

Observation	Reason	Solution
High THD	Your system is not linear	Decrease the perturbation amplitude of the input signal
High NSD	Your system is not yet stationary	Increase the time of the rest period before the EIS measurement
High NSR	Your output signal is too small	Increase the perturbation amplitude of the input signal

Essential Boosters

FlexP external booster

Power EIS with FlexP

EIS provides valuable information about working electrical devices. It helps identify the kinetic properties of multiple processes within the device under test.
Power EIS brings unmatched insight to very high-power units that have been out of reach until now.
Driven by SP-150e, VSP, VSP-3e or VMP-3e potentiostat/galvanostats, the **FlexP** brings unparalleled electrochemical knowledge and methodology to high-power applications.

Configurations
- 60 V/50 A with the FlexP0060 to address battery pack characterization
- 12 V/200 A with the FlexP 0012 to address electrolyzer and fuel cell/electrolyzer characterization

Features

- Voltage up to 60 V
- Current up to 200 A
- Parallel ability (x4)
- 10 kHz - 1 mHz EIS capable
- Up to 2.4 kW continuous with water cooling
- Cell temperature measurement included

Internal & external Boosters

Deliver more power to your application

SP-150e, VSP, VSP-3e and VMP-3e potentiostats can be interfaced to a separate current booster unit. These modular booster units can be filled with different booster boards (2, 5, 10, or 20 A). The standard booster chassis offers 8 available booster slots, each of them connected to a potentiostat board.

For higher current, 80 and 100 A booster units are available. They also exist as stand-alone systems (HCP-803, HCP-1005 see page 15).

Configurations
- External:
  - ±2 A, ±5 A, ±10 A, ±20 A on ±10 V adjustable from −20 to +20 V
  - ±80 A on ±3 V
  - ±100 A on [0.6 - 5] V
- Internal kit (only for VSP):
  - ±4 A ±10 V adjustable from −20 to +20 V

HCP-803

High current potentiostat
for supercapacitors and fuel cells

The **HCP-803** is a High Current Potentiostat capable of handling **±80 A** with a voltage range of **±3 V**. It is primarily designed for applications in the fuel cell/electrolyzer and supercapacitor areas.

It is a combination of a research quality potentiostat and an 80 A booster built into the same chassis. The potentiostat has the same specifications as the VMP-3e potentiostat boards (with EIS option) when not connected to the booster portion of the unit.

Applications

- Fuel cell/Electrolyzer
- Photovoltaic systems
- Supercapacitors
- Electroplating
- Battery

HCP-1005

More power for battery testing

The **HCP-1005** is a compact High Current Potentiostat specially designed to study high capacity secondary batteries. With a voltage range of **0.6 to 5 V** and a current range of **±100 A**, this unit can be used to test Li-ion high current cells. The EIS capability integrated in the chassis is ideal for aging tests.

The HCP-1005 structure is similar to the HCP-803. It combines a research potentiostat and a 100 A booster built into the same chassis.

Applications

- Lithium-ion
- Nickel-Cadmium
- Nickel-Metal hydride
- Battery

Features

- Booster range included in the autoranging (for boosters up to 20 A)
- EIS capability
- Plug-in module or external chassis
- Plug-and-play
- 5-lead connection type
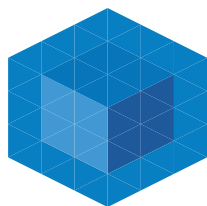
EC-Lab® Software
As powerful as it is user-friendly

Your hardware is only as good as your software. BioLogic's EC-Lab® software unlocks the full potential of your potentiostat. With over 30 years of continuous development and a commitment to user feedback, EC-Lab® has become the benchmark in electrochemistry control software. This powerful and user-friendly suite offers unmatched functionality, allowing you to run a wide range of techniques, analyze data with ease, and ensure your experiments are efficient and reliable. Regular updates based on user input keep EC-Lab® at the forefront of the field, guaranteeing you'll always have the most advanced and user-friendly techniques available. Focus on your research, not your software – choose EC-Lab®.

Display mode

Most of the experimental parameters can be **modified "on the fly"** during the experiment, with the changes stored into the raw data file.

The software interface is **adjustable** to create the best possible working environment for the user.

EC-Lab®'s graphics package provided with the software includes a powerful 3D plot feature and a tool to create **unique graph templates.**

Using our advanced "Process" function, the user can create new variables for each axis. This enables mathematical functions to be performed on data plotted **on any axis** (x, y1 and y2).

EIS measurements

EIS measurements can be made in both controlled potential and controlled current modes from 10 µHz to 7 MHz.

The patented **"drift correction"** algorithm and multiple stability parameters allow users to acquire high-quality data from their EIS measurements.

Applications

- Impedance spectroscopy
- General electrochemistry
- Electro-analytical
- Corrosion
- Battery
- Super-capacitor
- Fuel cell/Electrolyzer
- Photovoltaic cell

Experiment sequence builder

**EC-Lab®** software contains more than **80 techniques.** These techniques can address applications in voltammetry, EIS, corrosion and energy source/storage development.

A **powerful technique builder** can execute a series of different modular techniques as well as wait and loop tasks to create complex experimental sequences.

Moreover, within each technique, the user can create **up to 100 linkable sequences** of an experiment with different parameters. An email can be sent to the user, if desired, to inform him/her when a certain step of the experiment has been reached. Battery cycling can be synchronized with a **temperature control unit.**

EC-Lab® provided with...

- **Single potentiostat** / **galvanostats:**
  - SP-50e, SP-150e, SP-200, SP-240, SP-300
- **Bipot:**
  - SP-150e, SP-300
- **Multi-potentiostat** / **galvanostats:**
  - VMP-300, VSP, VMP-3e, VSP-300, VSP-3e
- **High current potentiostat** / **galvanostats:**
  - HCP-803, HCP-1005
- **Battery test stations:**
  - MPG2, MPG-205
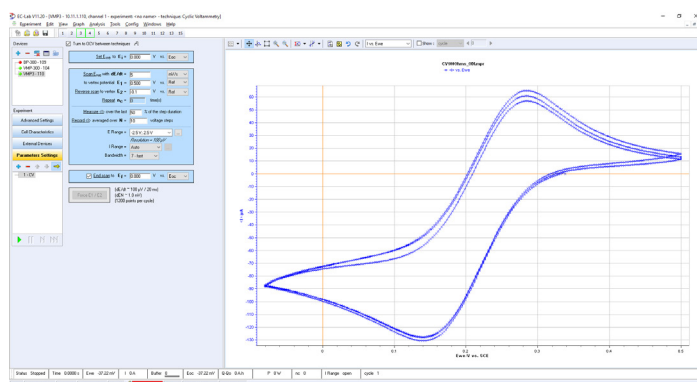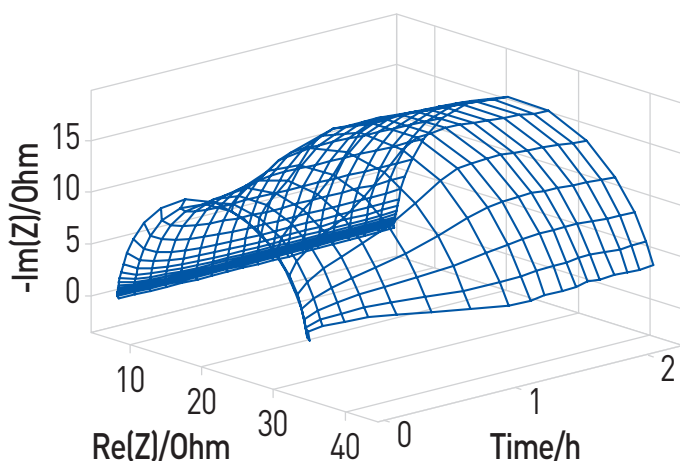
EC-Lab® Analysis package

An extended range of analyses

Display

Powerful electro-analytical analysis tools (such as peak find/height, convection wave, integral, Tafel fit, Rp determination) are available in **EC-Lab®**. These analyses incorporate typical fit routines (linear, polynomial, multi-exponential) and algorithms. All the analysis results are stored in a separate file.

Fitting

EC-Lab®'s EIS modeling package, ZFit, utilizes the equivalent circuit approach. There are over 150 standard circuits and two minimization algorithms available to help understand impedance plot information.

The user can define and build his own circuit model using a range of fourteen simple elements (R, C, L, Q, W, G, W_δ, W_{inf} M, G_α, G_β, L_α, M_α, M_γ). The last elements can be assimilated to transmission lines.

A batch processing feature allows the fitting of multiple cycles in an impedance experiment. Cable effects can be compensated by using cable compensation tool.

Simulation

Several tools are available to simulate CV curves, Tafel plots or EIS data and can be used as training tools.

CV Sim allows the user to create data with different mechanisms such as single (E) or multi (up to EEEEE) electron transfer. Electron transfer reactions can also be mixed with chemical reactions to simulate an EC mechanism.
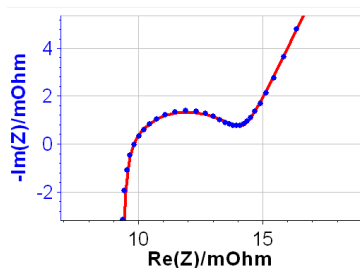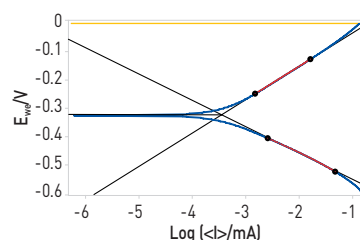
General electrochemistry

	Peak Analysis...
	Wave Analysis...
	CV Fit...
	Levich...
	Koutecky-Levich...

Corrosion

	R_p Fit...
	Tafel Fit...
	Electrochemical Noise...
	Corr Sim...
	VASP Fit...
	CASP Fit...

EIS

	Z Fit...
	Z Sim...
	Mott-Schottky...
	Compensation...
	Kramers-Kronig...

Battery process

	Process data (capacity, efficiency, energy...)

Photovoltaic

	Photovoltaic analysis (fill factor, efficiency...)

Math

	Polynomial Fit...
	Multi-Exponential Fit...
	Line Fit...
	Subtract Files...
	Integral...
	Min Max...
	Filter...
	Fourier Transform...
	Linear Interpolation...

17

Detailed Specification

Channel Specifications

	Premium	Essential
General		
EIS capability	10 µHz to 7 MHz	10 µHz to 1 MHz
EIS Quality Indicators	Yes	Yes (with "e" type channel board)
Analog Ramp Generator	Yes (1 MV/s), sampling rate 1 µs	n.a.
Floating option	Floating, WE to Ground, CE to Ground	CE to Ground
Permeation (WE to Ground)	Yes	No
Multi-electrode (CE to Ground)	Yes	Yes
Filters	Hardware/software	Software
Acquisition time	12 µs (1 µs with ARG option)	20 µs
Electrodes connections	2, 3, 4, 5	2, 3, 4, 5
IR compensation	Manual, EIS, current interrupt (software and hardware)	Manual, EIS, current interrupt (software)
Current		
Maximum current	±500 mA	±400 mA for VSP ±1A for "e" series chassis
Current ranges — with standard board	9: 10 nA to 1 A	6: 10 µA to 1 A
Current ranges — with low current option	13: 1 pA to 1 A	N.A
Lowest accuracy — with standard board	±100 pA on 10 nA range	±20 nA on 10 µA range
Lowest accuracy — with low current option	±100 fA on 1 pA range	N.A
Lowest resolution — with standard board	0.8 pA on 10 nA range	0.8 nA on 10 µA range
Lowest resolution — with low current option	80 aA on 1 pA range	N.A
Current booster — internal	1 A, 2 A, 4 A, 10 A, Up to 150 A	4 A for VSP only
Current booster — external	Premium External: HCV-3048 (30A/48 V)	2, 5, 10, 20, 80, 100 A, FlexP0060, FlexP0012 *
Input impedance	1 TΩ (//10 pF), ULC: 100 TΩ (//6 pF)	1 TΩ (//20 pF)
Voltage		
Compliance	±12 V	±10 V
Max applied potential	±10 V (±48 V with 1 A/48 V booster)	±10 V adjustable between [-20 ; +20] V *
Resolution	1 µV on 60 mV	5 µV on 300 mV
Accuracy	< ±1 mV	< 20 mV
Range	±2.5 V, ±5 V, ±10 V, ±25 mV, ±250 mV	±2.5 V, ±5 V, ±10 V
Maximum scan rate	200 V/s (1 MV/s with ARG option)	200 V/s
Control amplifier		
Potentiostat bandwidth	8 MHz	1 MHz
Potentiostat rise/fall time	< 500 ns	< 2 µs
General		
I/O (analog/TTL)	3/2	3/2
Interfaces	Ethernet, USB 2.0	Ethernet, USB 2.0

n.a.: not available   *Except for SP-50e

Chassis Specifications

Premium	SP-200	SP-300	VSP-300	VMP-300
Slots available	1	2	6	16
Dimension (WxDxH)	167 x 410 x 225 mm	205 x 410 x 225 mm	254 x 517 x 337 mm	448 x 455 x 280 mm
Weight	7.2 kg	7.5 kg	20 kg	30 kg
Power Requirement	350 W	350 W	650 W	1500 W

Essential	SP-50e	SP-150e	VSP	VSP-3e	VMP-3e
Slots available	1	2	5	8	16
Dimension (WxDxH)	136 x 372 x 209 mm	136 x 372 x 209 mm	435 x 335 x 95 mm	225 x 320 x 405 mm	495 x 465 x 260 mm
Weight	3.9 kg	3.9 kg	8 kg	12 kg	15 kg
Power Requirement	110 W	110 W	300 W	1000 W	850 W

Applications

	Premium					Essential		
	Std	EIS	ULC*	Booster(1)	ARG**	Std	EIS	Booster (2)
Education	■	■				■	■	
General electrochemistry	■	■	■			■	■	
Electroanalytical	■	■	■			■	■	
Electro-catalysis	■	■	■	■	■	■		■
Nanotechnology/sensors	■	■	■	■	■	■	■	
Battery	■	■		■		■	■	■
Supercapacitor	■	■		■		■	■	■
Fuel cell/Electrolyzer	■	■		■		■	■	■
Solar cells	■	■		■		■	■	■
Electrolysis				■				■
Pack of cells	■	■		■		■	■	■
Corrosion	■	■	■			■	■	
Coatings	■	■	■	■	■	■	■	
Materials	■	■	■	■		■	■	

For each instrument, modules can be mixed together

■ suitable   ■ recommended   ■ excellent

* ULC: Ultra Low Current ** ARG: Analog Ramp Generator (1) more details on page 11 (2) more details on pages 14-15.

Premium Boosters Specifications

	±1 A/±48 V	±2 A/±30 V	±4 A/[-3;14] V	±10 A/[-1;6] V	HCV-3048
Current					
Compliance	±1 A	±2 A	±4 A	±10 A	±30 A (±120 A with 4 units)
Accuracy	< 2 mA on 1 A range	< 4 mA on 2 A range	< 8 mA on 4 A range	< 20 mA on 10 A range	< 150 mA on 30 A range
Auto-ranging	yes	yes	yes	yes	0.3 A; 3 A; 30 A
Voltage					
Compliance	±49 V	±30 V	–3 V ; +14 V	–1 ; +6 V	–1 ; +50 V
Control	±48 V	±30 V	–3 V ; +10 V	–1 ; +6 V	0 ; +48 V
Features					
EIS frequencies	2 MHz – 10 µHz	1 MHz – 10 µHz	1 MHz – 10 µHz	1 MHz – 10 µHz	500 kHz – 10 µHz
Bandwidth (–3 dB)	> 2 MHz	> 3 MHz	> 4 MHz	> 8 MHz	120 kHz
Slew rate (no load)	> 15 V/µs	50 V/µs	50 V/µs	50 V/µs	> 20 V/µs
Rise/fall time (no load)	< 250 ns	< 200 ns	< 200 ns	< 200 ns	< 3 µs
Floating mode	yes	yes	yes	yes	yes
Parallel ability	yes	yes	yes	yes	yes up to 4
Connection	2, 3, 4, 5 leads	2, 3, 4, 5 leads	2, 3, 4, 5 leads	2, 3, 4, 5 leads	2, 3, 4 leads

Essential Boosters Specifications

	2/4/5 A	10/20 A	80 A/HCP-803	100 A/HCP-1005
Current				
Compliance	2 A: ±2 A, 4 A: ±4 A, 5 A: ±5 A	10 A: ±10 A, 20 A: ±20 A	±80 A	±100 A
Accuracy	2 A: < 4 mA on 2 A range, 4 A: < 8 mA on 4 A range, 5 A: < 10 mA on 5 A range	10 A: < 20 mA on 10 A range, 20 A: < 40 mA on 20 A range	< 800 mA on 80 A range	< 1 A on 100 A range
Auto-ranging	yes	yes	no	no
Voltage				
Compliance	±10 V	±10 V	±5 V (At 1 A) ±3 V (At 80 A)	0.6 – 5 V
Control	±10 V adjustable between [-20 ; +20] V	±10 V adjustable between [-20 ; +20] V	±5 V (At 1 A) ±3 V (At 80 A)	0.6 – 5 V
Features				
EIS frequencies	2 A: up to 150 kHz, 4 A: up to 130 kHz, 5 A: up to 125 kHz	10 A: up to 80 kHz, 20 A: up to 30 kHz	up to 20 kHz	up to 10 kHz
Bandwidth (–3dB)	1 MHz	1 MHz	1 MHz	1 MHz
Rise time and fall time (no load)	15 µs (potentio) 40 µs (galvano)	25 to 60 µs (potentio) 50 to 120 µs (galvano)	95 µs (potentio) 150 µs (galvano, 10 mΩ)	1.7 ms (potentio) 4 ms (galvano, 20 mΩ)
Parallel ability	no	no	no	no
Connection	2, 3, 4, 5 terminal leads	2, 3, 4, 5 terminal leads	2, 3, 4, 5 terminal leads	2, 3, 4, 5 terminal leads
General				
1 external input	security to open circuit (TTL level)	security to open circuit (TTL level)	security to open circuit (TTL level) Emergency push button	Security to open circuit (TTL level) Emergency push button

	FlexP 0060	FlexP 0012
Current		
Compliance	50 A up to 200 A (4 in parallel)	200 A up to 800 A (4 in parallel)
Accuracy	0.2% of value ±0.1% FSR < 200 mA at 50 A	0.2% of value ±0.1% FSR < 800 mA at 200 A
Voltage		
Compliance	[-2.5 ; +60] V (water cooled)	[-2.5 ; +11.9] V (water cooled)
Control	[-2.5 ; +60] V (water cooled)	[-2.5 ; +11.9] V (water cooled)
Features		
EIS frequencies	10 kHz	
Bandwidth (–3dB)	–	
Rise time and fall time (no load)	< 10 µs	< 20 µs
Parallel ability	yes up to 4	
Connection	2, 3, 4 terminal leads	
General		
1 external input	Embedded (cell temperature and emergency)	

Battery Test Stations & Cyclers

A full range of battery testers

Energy storage and conversion devices demand testing each component thoroughly. Depending on the application, requirements for testing can be different. BioLogic has a solution to fit every stage of development, **from materials and components research to full cell testing and validation.**

Early research can utilize the M470 for detailed local analysis or the MTZ-35 for high impedance measurements (up to 35 MHz). With a range of current and voltage options, internal and external booster options, and up to 16 channels, BioLogic potentiostat/galvanostats, like the VMP-3e and the VMP-300, are the right choice at this stage of development.

The MPG-200 series is an intermediary research grade solution. Offering 2 or 3 electrode configurations, negative voltage, and a maximum of 80 channels per rack, this instrument is perfect for researchers in the late developmental stages.
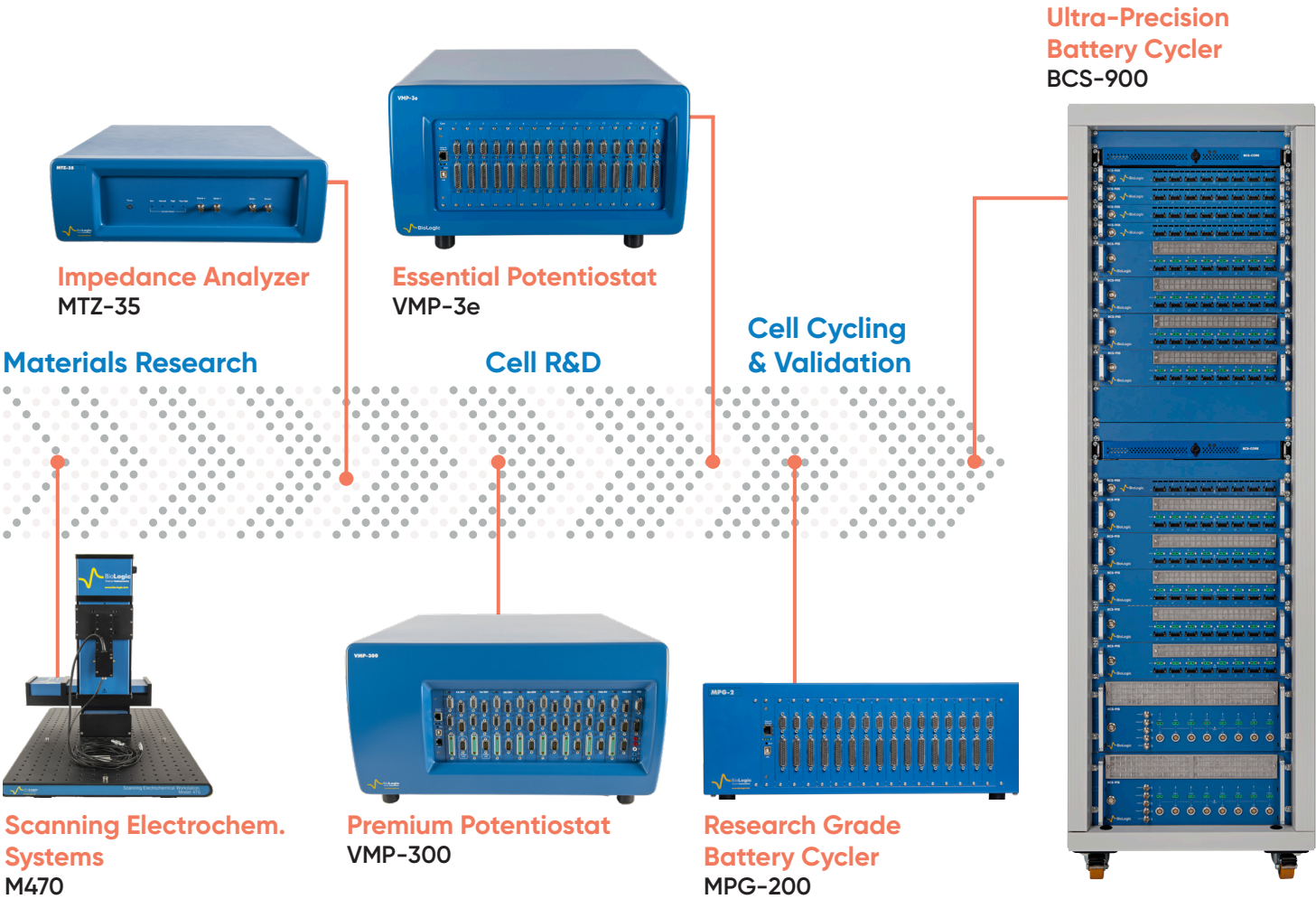
At the cell cycling & validation stage, the BCS-900 offers the Best-in-Class solution of any battery cycler. Based on well proven hardware, this instrument combines versatile and modular battery cyclers with intuitive and user-friendly software. Redundant local data storage and operation ensures secure data. Additionally, integrated and native EIS allows researchers to increase efficiency. With a single cabinet able to hold up to 228 channels, the BCS-900 is perfect for high throughput battery cycling.

At whatever stage in battery development, BioLogic has the right solution.

How to choose a battery tester?

	VMP-3e/VMP-300	MPG-200 series	BCS-900 series
Application	**Materials research / Cell R&D**	**Cell R&D / Cell cycling & validation**	**Cell cycling & validation**
Current ranges	1 pA – 150 A	10 µA – 5 A	5 ranges for each model up to 150 mA (BCS-905), 1.5 A (BCS-910), 15 A (BCS-915)
Voltage range	±10 V	±10 V on MPG-2 –2;9 V on MPG-205	0–+10V (BCS-905, BCS-910) –2.5V–+7.5V (BCS 905/n) –5V–+5V (BCS 910/n) 0–+9V (BCS 915)
EIS frequency range	7 MHz – 10 µHz	100 kHz – 10 µHz	10 kHz – 10 mHz
Built-in EIS	Yes. Optional on each channel		Yes. Optional on each module
Acquisition time	200 µs/1µs with ARG option	200 µs	1 ms
Electrode connection	2,3-electrode/5-points measurement with CE measurement	2-electrode/4-points measurement 3-electrode/5-points on MPG-2	2-electrode/4-points measurement
HPC measurement	Yes. Down to 6 ppm	Yes. Down to 6 ppm	Yes. Down to 6 ppm
Channels/module	16		8
Max Channels/cabinet	–	80	228

Battery innovation at every stage

Ultra-Precision Battery Cycler
BCS-900

Impedance Analyzer
MTZ-35

Essential Potentiostat
VMP-3e

Cell Cycling & Validation

Materials Research

Cell R&D

Scanning Electrochem. Systems
M470

Premium Potentiostat
VMP-300

Research Grade Battery Cycler
MPG-200

BCS-900 series.

High-end cyclers for demanding needs

Building on BioLogic's established reputation for reliable instrumentation, the BCS-900 Battery Cycler represents a revolutionary leap forward. This system merges unmatched performance with a user-centric design owing to the groundbreaking BT-Lab® software suite, the latest innovation in battery testing technology.

BT-Test™ integrates cutting-edge features that empower researchers with unparalleled control and flexibility in designing, running and monitoring cycling experiments. Researchers can effortlessly control variables to tailor experiments to their exact specifications, ensuring the acquisition of highly accurate and insightful data.

For demanding battery data processing, in-depth and automated analysis is completed with BT-Analysis™. Analyses are adapted to specific needs with unmatched flexibility. Access to critical data anytime, anywhere – online or offline – ensures key data is never missed. BT-Analysis™ empowers detailed analysis by displaying data in various formats, including vs. cycles, loops, and steps. It even displays application-oriented graphs, tables, and statistical tools in order to gain a deeper understanding of battery behavior.

Specifications

- 8 channels rackable modules
- **BCS-905** (150 mA), **BCS-910** (1.5 A) and **BCS-915** (15 A)
- Extendable current control **up to 120 A**
- **5 current ranges** on each module
- Cell tests **up to 10V and down to –5V**
- Measurement resolution down to 40 µV (18 bit)
- Fully integrated **native EIS** from 10 mHz to 10 kHz
- HPC measurement down to 6 ppm
- Mix for **modularity** in 4 cabinet sizes: 6U, 12U, 24U, 38U
- A **high-end** measurement chain completed by 4-point connection cell holders

Run reliable & safe tests

Battery cycling tests are long term and high stakes and the BCS-900 series is the only battery cycler on the market with an on-board SSD drive, ensuring data is never lost. A dedicated and embedded operating system and local storage redundancy guarantees demanding data processing needs are met. Automatic or manual actions can be defined with safety limits and built-in security features to ensure the integrity of tests is never compromised.

Remote or on-site real-time updates are available - without needing to connect the system to a PC - making it a truly independent instrument.

Adapt to evolving needs

Flexibility and modularity are key, with the BCS-900 each cabinet can be customized for modular setup to meet the user's specific needs. Users can combine BCS-900 modules and achieve measurements ranging from a few µA up to 120 A, while maintaining high precision for every current range. The voltage range possibilities varie depending on the models allowing to adapt to the various cell cycling situations up to 10V and down to -5V.

Comprehensive from test to analysis

Starting with a turnkey installation, the BCS-900 series has an application-oriented design. Higher fidelity is guaranteed with features like fully integrated EIS analysis and flexible and automated Test Plan settings. The Recipes feature automatically generates graphs and tables that users can display in overlays, allowing for simultaneous data analysis.

Control & measure with precision

Each module of the BCS-900 series offers unparalleled precision, accuracy, and resolution across five current ranges tailored to accommodate diverse battery capacities and C-rates, ensuring the utmost accuracy is maintained. Its seamless CC-CV switch and minimal standard deviations between channels enhance performance. With a 1 ms continuous sampling and processing rate, along with oversampling capabilities enabling averaging and achieving exceptionally low signal-to-noise ratios, setting a new standard in battery testing technology.
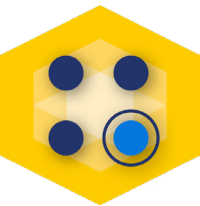
Control, Acquisition and Monitoring

Batch Data Analysis
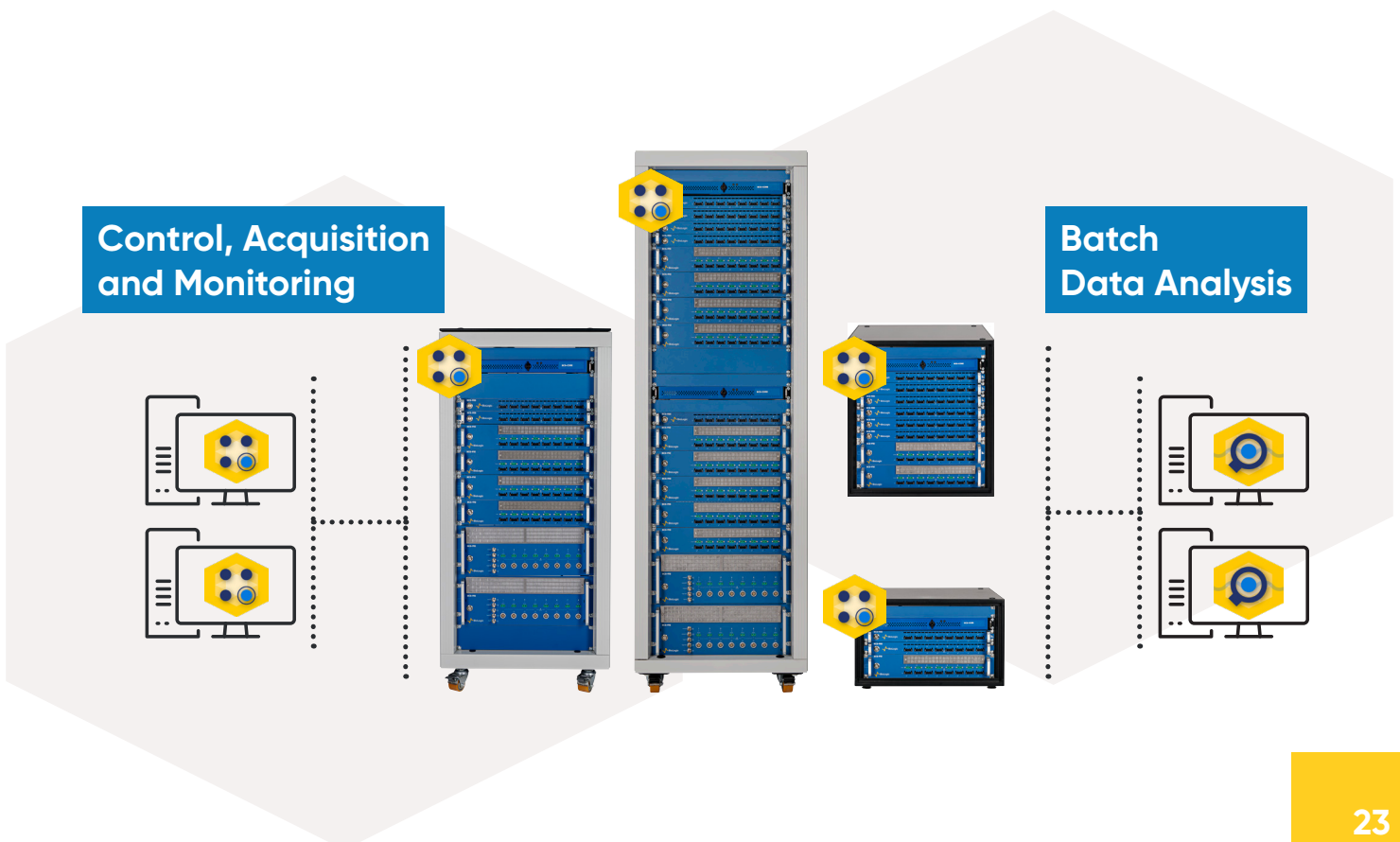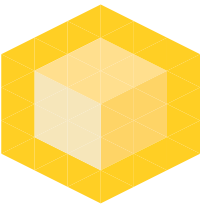
BT-Lab® Software Suite
From reliable tests to efficient analysis

The BCS-900 series Battery Cyclers feature BT-Lab® Software Suite, the latest advancement in battery testing technology. This groundbreaking software integrates state-of-the-art features to enhance control, monitoring, and analysis capabilities for rigorous battery testing applications.

Ensuring the utmost reliability in cycling procedures, continuous monitoring throughout testing is provided by our embedded BT-Test™, guaranteeing consistent and accurate results. Efficiency in data analysis is further optimized through the advanced BT-Analysis™ software, enabling rapid and insightful interpretation of complex datasets. Specifically engineered for battery testing, essential features such as native EIS provide researchers and engineers comprehensive tools to delve deeper into battery performance and behavior.

BT-Test™
For cycling control, acquisition and monitoring

Flexible and automated **test plan design**

- **Application oriented** and modern interface with **user-friendly grid**
- Evolutive test plans with dynamic and DUT type variables for test automation:
  - **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
- Flexible user management for confidentiality

Test run monitoring and acquisition

- **Embedded software** operation
- Redundant storage for **data safety**
- Global view to monitor all **channels status**
- Local and remote setup and monitoring
- **Activity log** access
- **On-the-fly** test plan **modifications**
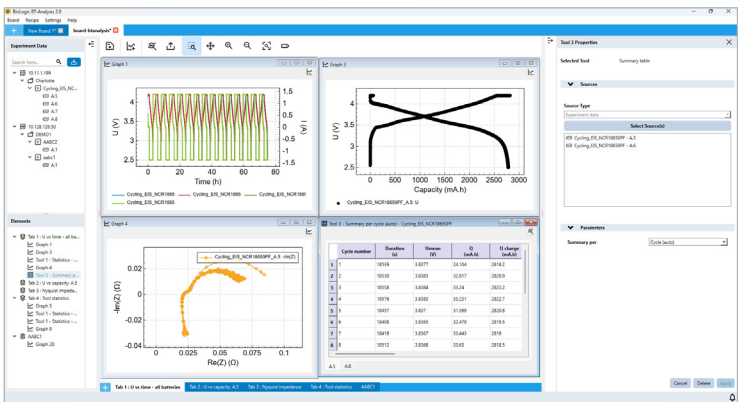- **Live data** display
- Flexible text export
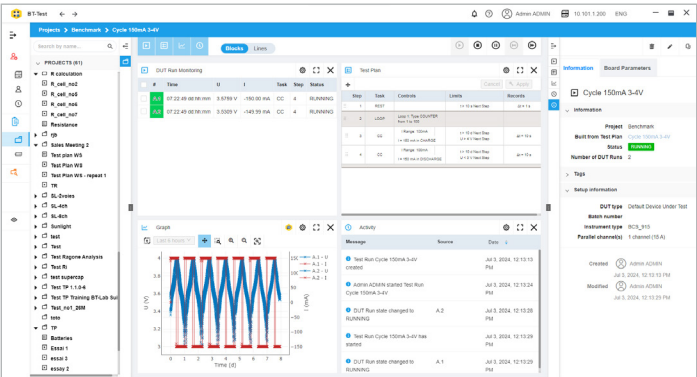
BT-Analysis™

For batch data processing and display

Automated and flexible test analysis

- User-friendly and intuitive navigation: fast learning curve
- Customizable graphical and tabular representation
- **Remote access** to database for live data **import**
- **Online and off-line** data access
- Multiple **application-oriented** graphs, tables and statistical tools
- Refresh displays of multiple sets of data in real time
- Display data in multiple formats including cycles, loops and steps
- Compare cells between each others and previous tests

Test reporting and export

- Generate displays for reports during tests
- Flexible and customizable graph formatting
- Recipes for automated batch graph and table generation
- 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 (Umean, Qcharge, Qdischarge) vs. cycle or loop time
- Export tables and formatted graphics

Work anywhere

The BT-Lab® Software Suite offers an unprecedented amount of flexibility, giving researchers more freedom to access their data. Using BT-Test™, Test Run monitoring can be as simple as opening a web browser. With BT-Analysis™, live data management and processing can be accessed remotely.

Native EIS

Electrochemical Impedance Spectroscopy (EIS) is a valuable tool for researchers and developers in the field of battery technology. It offers a non-destructive way to gain insights into the internal processes of a battery, providing information that traditional DC measurements cannot. BioLogic's instruments, with their fast bandwidth controllers, offer both potentio- and galvano- control for EIS measurements in a 10 kHz to 10 mHz frequency range.

Why EIS for battery testing?

By applying a small AC signal across a range of frequencies, EIS measures the battery's impedance. Analyzing this data unlocks details about various aspects of the battery's operation, including:

- Charge transfer kinetics at the electrode/electrolyte interface
- Ionic transport properties within the electrolyte
- Solid Electrolyte Interface (SEI) formation and stability
- Equivalent circuit modeling for battery performance prediction
- Indicate degradation mechanisms like electrode aging or electrolyte breakdown.

Benefits of Native and Integrated EIS

Integrated EIS eliminates the need for third-party instrumentation, offering a more streamlined and user-friendly experience. With native EIS, the entire testing process, from setting parameters to data acquisition and analysis, can be performed within a single platform, improving efficiency, and reducing risk of errors during data transfer between instruments.
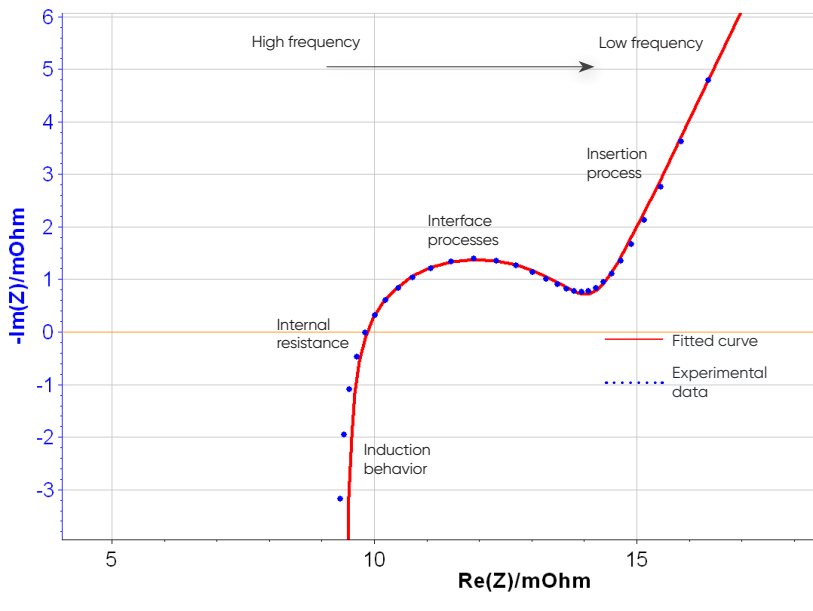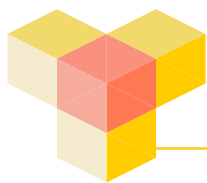
MPG–200 series

R&D grade battery test stations

The **MPG–200 series** is offered in two fixed configurations with or without EIS on every channel:
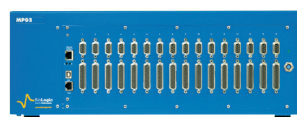- **MPG-2**: 16 channels/100 mA each
- **MPG-205**: 8 channels/5 A each

The **MPG–200 series** can be provided in a rack capable of supporting up to 5 units.

Only one computer is necessary to control all units thanks to the solution's Ethernet capability. With this connection, the **MPG–200 series** can be installed on a Local Area Network to allow multiple users to access instruments and follow battery cycling remotely.
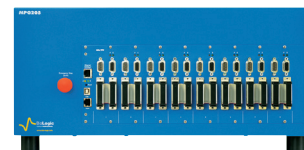
The **MPG–200 series** offers temperature measurement and three optional connection modes to the battery (battery holder, short or long cables). Each channel has two analog inputs and one analog output to interface with external instruments.

MPG-2

- 16 channels
- 100 mA
- 3 electrodes/5 points

MPG-205

- 8 channels
- 5 A
- 2 electrodes/4 points

Specifications

- **Current ranging:** 10 μA up to max current with a resolution 0.004% of the range
- Resolution of 300 μV programmable down to 5 μV by adjusting the dynamic range (100 μV resolution on 5 V range)
- **Acquisition time**: 200 μs
- No limit in time and data recording

Options

- EIS (100 kHz to 10 μHz)
- Rack (5 units)
- Short (25 cm) or long cables (2.5 & 3 m)
- Temperature probe
- Coin cell, cylindrical and pouch cell holders (see Accessories catalog)
- 5 A booster for MPG 2

Software

Like BioLogic potentiostat / galvanostats, the MPG-200 series is supplied with **EC-Lab® software.** It provides techniques specifically designed for batteries and general electrochemistry applications, such as cyclic voltammetry. An extended range of analyses are also available (capacity, efficiency, energy, etc). Note that **EC-Lab®** allows the control of several VMP-3e/VMP-300 or MPG-200 instruments from one session.

Detailed Specification

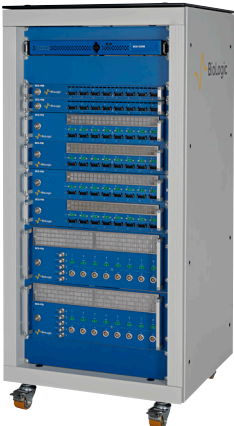|	BCS-905 & BCS-905/n	BCS-910 & BCS-910/n	BCS-915
Channels	8		
Voltage			
Range	0 V to 10 V –2.5 V to 7.5 V for /n model	0 V to 10 V –5 V o 5V for /n model	0 V to 9 V
Control resolution	150 µV		
Measurement resolution	40 µV (18 bit)		
Accuracy	<±0.01% of value ±0.3 mV		
Slew rate	150 kV/s	150 kV/s	3 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.

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, Zfit

6U Cabinet

12U Cabinet

24U Cabinet

38U Cabinet

	MPG-2	MPG-205
Channels/module	16	8
Cell connection	2, 3, 4 or 5 terminal leads	2 or 4 terminal leads
Cell control		
Compliance	±10 V @ 100 mA	-2 V; 9 V @ 5 A
Maximum current	±100 mA continuous	±5 A continuous
Maximum potential	10 V @ 100 mA	9 V @ 5 A
Potential resolution	300 µV down to 5 µV	
Current resolution	0.004% of FSR* /0.8 nA	
Current accuracy	±0.1% of control ±0.01% of FSR*	
Voltage measurement		
Ranges	±10 V, ±5 V, ±2.5 V	0 - 5 V, 0 - 10 V
Accuracy	±0.1% of control ±0.01% of FSR*	
Resolution	0.004% of FSR*	
Acquisition speed	200 µs	
Noise (peak to peak 0-100 kHz)	600 µV	
Curent measurement		
Ranges	±100 mA, ±10 mA, ±1 mA, ±100 µA, ±10 µA, autorange	±5 A, ±1 A, ±100 mA, ±10 mA, ±1 mA, ±100 µA, ±10 µA, autorange
Accuracy	±0.1% of control ±0.01% of FSR*	
EIS option		
Frequency range	100 kHz to 10 µHz	
Amplitude	1 mVpp to 1 Vpp, 0.1% to 50% of the current range	
Mode	Single Sine, Multi Sine, FFT analyis	
General		
Dimensions (W x D x H)	260 x 495 x 465 mm	254 x 494 x 454 mm
Power requirements	350 W, 85-264 V, 47-440 Hz	860 W, 85-264 Vac, 47-440 Hz
Weight	17 kg	25 kg

*FSR: Full Scale Range

Impedance Analyzer

A wide range of comprehensive solutions.
From impedance analyzer to temperature control units and sample holders

MTZ-35

35 MHz Impedance Analyzer

The **MTZ-35** is an impedance analyzer dedicated to electrical characterization over the frequency range of **10 µHz to 35 MHz.**

The **MTZ-35** can be coupled with the High Temperature Furnace **HTF-1100** and the Intermediate Temperature System **ITS-e** in order to investigate materials properties over a wide temperature range (**-40 °C to 1100 °C**).

Three kinds of sample holders are offered: HTSH-1100 for high temperature use, Controlled Environment Sample Holder CESH-e for intermediate temperature use (-40 °C to 150 °C) and HTCC for liquids/gels materials in the temperature range between -50 °C and 180 °C.

Applications

- Ceramics
- Solid electrolytes
- Polymers
- Rubbers
- Dielectrics
- Composites
- Solar/photovoltaic cells
- Semiconductors
- Biological cells
- Liquids
- Electronic components

Specifications

| Generator	
Frequency range	10 µHz to 35 MHz
Voltage range DC	100 µV to ±10 V
Voltage range AC	100 µV to 10 V
Measurement ranges	
Inductance	10 nH to 10 kH
Capacitance	1 pF to 1000 µF
Resistance	1 mΩ to 500 MΩ
Basic accuracy	0.1%

MT-Lab® Software

MT-Lab® is an intuitive software used to control the MTZ-35. It also controls several temperature control units:
- High temperature furnace (HTF-1100)
- Intermediate Temperature System (ITS-e)
- Temperature control systems using Eurotherm 22xx/35xx controllers

Open circuit/Short circuit compensation

MT-Lab® software is provided with a compensation protocol for the compensation of residual impedance due to cell cables and test fixtures.
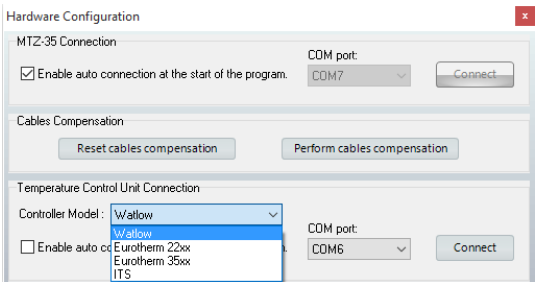
Temperature Control Unit

ITS-e

HTF-1100

|	Operating Temp.	Features
HTF-1100	RT to 1100 °C	Heating rate adjustable K-type thermocouple
ITS-e	-35 to 150 °C	Temperature accuracy: 0.3 °C PT1000 probes

Sample holders

HTSH-1100

CESH-e on its base

		Operating Temp.	Features	Compatibility
HTSH-1100	Φ=25 mm	RT to 1100 °C	Quartz tube for controlled atmosphere Leak tight up to 2 bar relative K-type thermocouple	HTF-1100 Tubular furnaces
	Φ=12 mm			
	Φ=03 mm			
CESH-e	CESH-e	-40 to 150 °C	For In-plane and Through-plane electrical measurements	ITS-e and other temperature units
HTCC	Platinized	-50 to 180°C	Cell factor: K= k=1.0 +/- 10% cm^{-1} Volume: 0.5 - 1.0 mL	ITS-e and other temperature units
	Non-platinized			

Temperature control management

Five temperature control modes are available with **MT-Lab**®. The software offers a wide range of heating rates and two temperature stabilization modes (fast and precise) based on closed-loop temperature regulation. Temperature control is optimized. Set-point temperatures are reachable and adjustable without overshoot.

A complete graphics package

MT-Lab® is very easy-to-use software. The settings and graphs are displayable on one screen view. The software includes numerous graphic tools and advanced tools for equivalent circuit modeling (ZFit). Users can build their own circuit model using a range of 14 electrical elements (R, C, L, Q, L_a, W, W_d, W_{inf}, M, M_a, M_g, G, G_a, G_b).
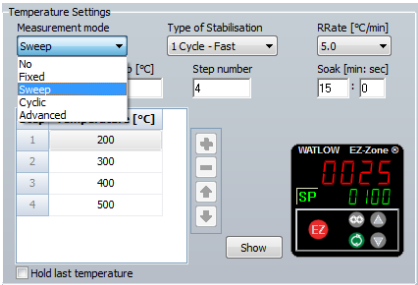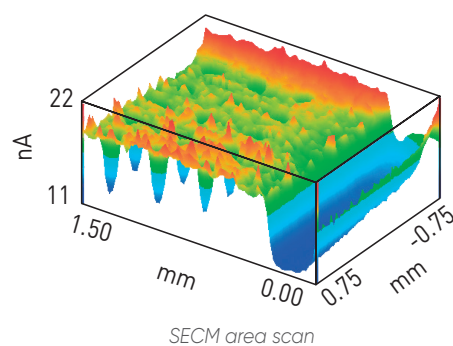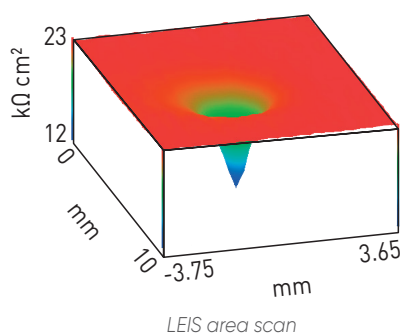
Scanning Electrochemical Workstation

Systems for localized electrochemistry measurement

The traditional potentiostat/galvanostat measures an average response of the electrode material, which is often considered to be homogeneous. However, for more detailed studies, it is interesting to look beyond this homogeneity to study the spatial dependence of electrode properties.

Our modular localized electrochemistry platform can include up to 9 distinct localized measurement techniques. The table below summarizes the techniques, the type of information that can be obtained, the resolution and typical applications.

LEIS area scan

SECM area scan

Scanning techniques		Information	Resolution	Applications
SECM	Scanning ElectroChemical Microscopy	Reactivity, conductivity	Probe size	Biology, catalysis, corrosion and coatings, materials, sensors, and sustainable energy, including fuel cells and batteries
ac-SECM	Alternating Current Scanning ElectroChemical Microscopy	Reactivity, conductivity, or localized EIS (no mediator required)	Probe size	Biology, catalysis, corrosion and coatings, materials, sensors, and sustainable energy, including fuel cells and batteries
ic-SECM	Intermittent Contact Scanning ElectroChemical Microscopy	Topography and reactivity or conductivity or localized EIS.	Probe size	Biology, catalysis, corrosion and coatings, materials, sensors, and sustainable energy, including fuel cells and batteries
LEIS	Localized Electrochemical Impedance Spectroscopy	Local impedance of the sample	Hundreds of μm	Batteries, and corrosion and coatings
SVP (SVET)	Scanning Vibrating Probe (Scanning Vibrating Electrode Technique)	Electrochemical activity	Tens of μm	Biology, batteries, and corrosion and coatings
SDS (SDC)	Scanning Droplet System (Cell)	dc electrochemistry in a droplet of electrolyte	Hundreds of μm	Catalysis, corrosion and coatings, and materials
ac-SDS	Alternating Current Scanning Droplet System	Impedance in a droplet of electrolyte	Hundreds of μm	Catalysis, corrosion and coatings, and materials
SKP	Scanning Kelvin Probe	Contact potential difference related to work function, and/or corrosion potential/topography	Probe size	Corrosion and coatings, materials, and sustainable energy, particularly photovoltaics
OSP	Optical Surface Profiler	Topography	100 nm (Z) 30 μm (X & Y)	Any field, complementary to the above
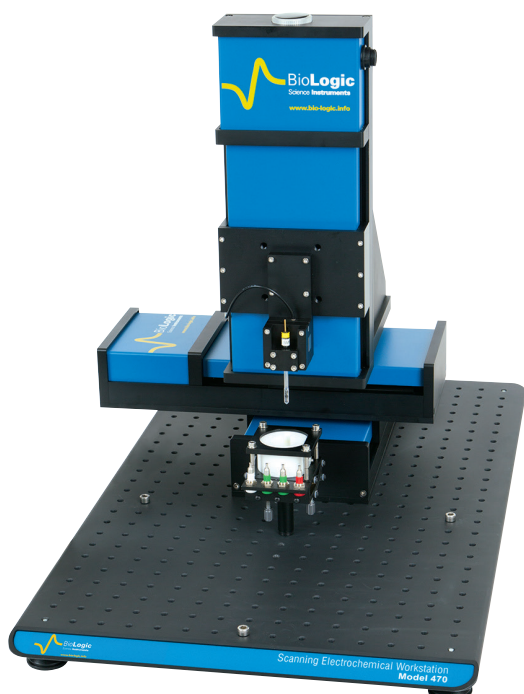
M470

Ultra-high-resolution scanning stage with multiple modular techniques

The M470 is the 4th generation of scanning probe systems, which includes a high-resolution scanning stage and the most comprehensive range of modular scanning probe techniques.

The M470 achieves the perfect balance of scan speed, resolution and accuracy to deliver the highest standard in spatially resolved electrochemical measurements.
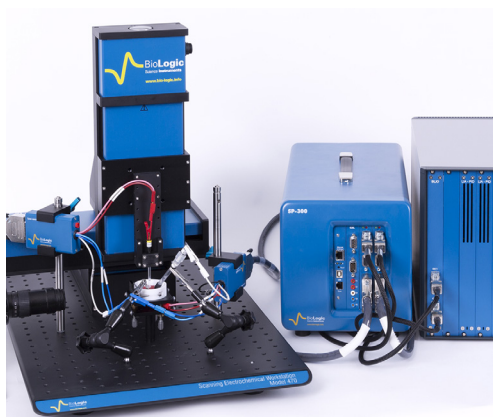
The fast, precise, closed-loop positioning system is designed specifically for the demands of scanning probe electrochemistry.

9 available techniques

- SECM*
- ac-SECM*
- ic-SECM*
- LEIS*
- SVET*
- SDS*
- ac-SDS*
- SKP
- OSP

* Additional: Electrochemistry, Corrosion and EIS suites included.

Options

The M470 is compatible with a large range of potentiostat /galvanostats:
- Single potentiostat: SP-200.
- Multichannel potentiostat: SP-300, VSP-300 and VMP-300

Any SP-/VSP-/VMP-configuration offers high dc-current measurement sensitivity and increased EIS bandwidth. Owners of Premium potentiostats have the option of purchasing the M470 system with a hardware interface to connect to their existing potentiostat.

To facilitate the mounting of low current amplifiers near the electrochemical cell, adjustable stands and brackets are provided which mount directly to the M470 base plate.

Glove Box Cables

Optional glove box cables are available for the M470. The cables replace the standard cables of the M470 allowing the control unit to remain outside of the glove box, while the scan head and attached devices are used inside the glove box. Each set includes the necessary cables and bulk head connector.

Scan-Lab® Software

All scanning probe microscopy systems come with **software updates** that allow the user to benefit from new features. The user is able to select an experiment from within the technique to provide a powerful user interface, fully configurable with options to save and recall complex setups.

Data can be manipulated within the experiment and allows 2D and **3D heat map** presentations as well as advanced analysis features. All experiments can be combined in a cutting-edge sequencing engine that incorporates logic elements such as loops, delays, probe movement and more, to provide a powerful research tool now and for the future.

3DIsoPlot adds a further component to the line-up by providing fully rendered **3D data** display. 3DIsoPlot allows data to be rotated, angled, flipped, scaled, zoomed and more to provide beautifully rendered imagery over a huge range of scales suitable for large posters or projections.

The Microscopic Image Rapid Analysis (MIRA) package rounds off the line-up with 2D and 3D surface analysis features for experiments such as approach curves and area scan imagery. This truly powerful package is gaining popularity due to its strong analytical capabilities.
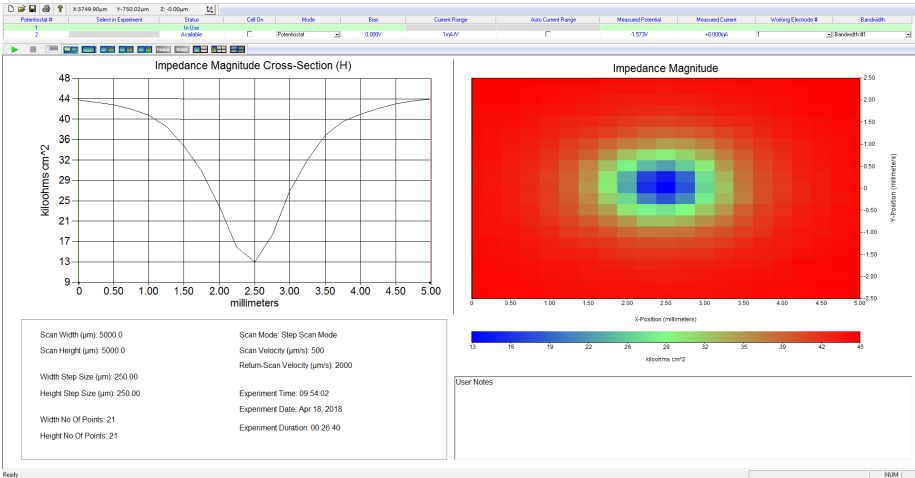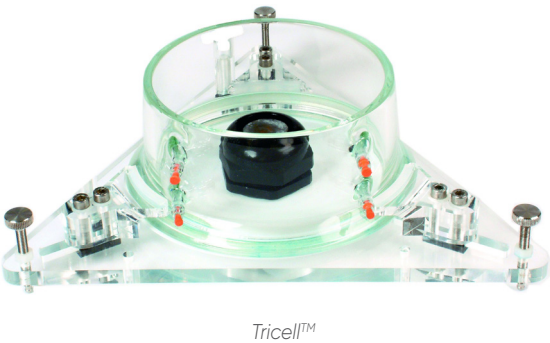
Probes

The foundation of a great measurement is a great probe, that's why we provide one of the most comprehensive range of probes, each individually characterized.

Technique	Materials	Options / sizes
SECM / ic-SECM	fused silica & platinum: Ø 4 mm	10, 15, 25 µm
SECM	borosilicate & platinum: Ø 2 mm	1, 2, 5, 10, 15 or 25 µm †
SVP (SVET)	LDPE & platinum	> 5 µm
LEIS	LDPE & platinum	> 5 µm
SKP	brass & tungsten	150 or 500 µm
SDS	PEEK	100 or 500 µm

† Each pack includes a 2 mm to 4 mm adaptor.

SKP

LEIS

SECM

Tools

Tricell™

A wide variety of optional accessories are also available, including various probe options, cell options (**environmental TriCell™, µTriCell™, shallow µTriCell™, Foil Cell**) and long working distance optical video microscope (**VCAM3**). Additionally, the **USB-PIO** module allows the M470 to monitor digital signal levels and switch external hardware synchronized with experiments and movements.

Specification

	M470
Number of techniques	9 techniques
Modular upgradability	yes
Positioning resolution	20 nm
Scanning range	110 mm
Max. scan speed	10 mm/s
Piezo positioning	yes (ic-SECM)
Potential range	±10 V
Current ranges	1 A to 100 pA
Analog to digital resolution	24-bit
Impedance range (VMP 300)	10 µHz to 3 MHz
VMP 300 family compatibility	yes

µTricell ™

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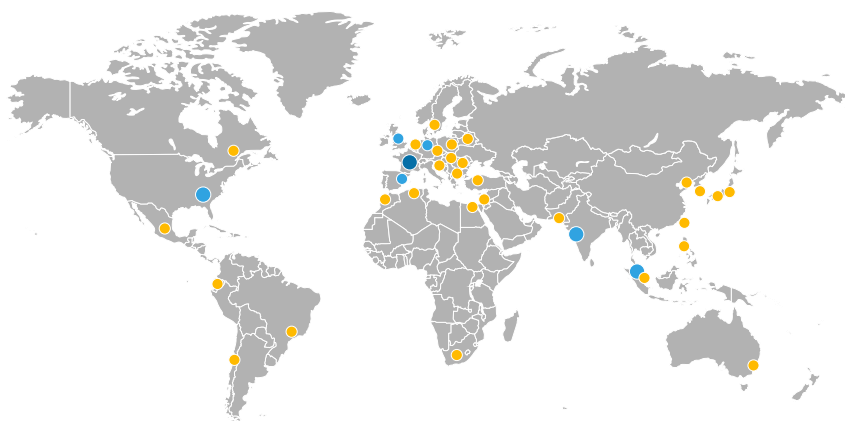United Kingdom
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