Electrochemistry instruments
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 helps 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
- High current boosters up to 800 A
- Extended voltage range up to 60 V
- Low current options (down to nA)
- Multiple user systems
- ARG (Analog Ramp Generator) to perform analog voltage ramp
- Scanning workstations with up to 9 different local techniques (dc-SECM, ac-SECM, LEIS, SKP, SVET, etc.)
- Fully featured impedance analyzer with temperature control

Controlled by a powerful suite of software
- Intuitive user interface
- Preset techniques for typical electrochemical applications
- Multi-technique experiment builder
- External device control
- Multiple graph display
- Data analysis & fit
- Safety & experimental limits
- Software calibration

Electrochemical Impedance Spectroscopy

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)
Potentiostat/Galvanostats
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Battery Test Stations & Cyclers
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R&D grade battery test stations 25
Battery cyclers 26
BT-Lab® software 27
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Impedance Analyzer 30

Scanning Electrochemical Workstation 32
**SP-200**

Transportable potentiostat/galvanostat

The SP-200 is a 500 mA research grade potentiostat/galvanostat for users who need to work their budget hard. 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 be easily 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-240**

4 A of power crammed into a compact chassis

SP-240 is a 4 A transportable potentiostat/galvanostat with EIS. Its integrated booster makes it the perfect instrument for any application in electrochemistry, especially energy device testing.

**Applications**
- General electrochemistry
- Sensors
- Corrosion
- Electrolysis/anodizing
- Coatings
- Materials
- Batteries
- 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.

**VMP-300**
The ultimate multichannel potentiostat

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

They 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.

**HCV-3048**
An unparalleled combination of power and speed

The HCV-3048 is designed for battery stack/pack characterizations. 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 products, helping to identify the kinetic properties of multiple processes within the device under test. The HCV-3048 brings unmatched insight to high-power systems.

**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 and BP-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**

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

**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

**Applications**

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

---

**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

---

**Premium Potentiostat/Galvanostats**

**Premium Boosters**
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
- Additional potentiostat/galvanostat/EIS
- Built-in EIS analyzer: up to 1 MHz
- External current boosters: Up to 800 A
- 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.

But 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 16).

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

Options
- Built-in EIS analyzer: up to 1 MHz
- External current boosters: Up to 800 A
- RDE control kit

VSP-3e  
A research-grade multi-channel 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 800A 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

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

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 multi-channel 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.

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

Options
- Built-in EIS analyzer: up to 1 MHz
- External current boosters: Up to 800 A
- RDE control kit
- Additional potentiostat/galvanostat/EIS
Three quality indicators are 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.

\[
THD_N = \frac{1}{\sum_{k=2}^{N} |Y_k|^2}
\]

**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.

\[
NSD_N = \frac{1}{\sum_{k=2}^{N} |Y_k|^2}
\]

**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.

**How do I use them?**

<table>
<thead>
<tr>
<th>Observation</th>
<th>Reason</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>High THD</td>
<td>Your system is not linear</td>
<td>Decrease the perturbation amplitude of the input signal</td>
</tr>
<tr>
<td>High NSD</td>
<td>Your system is not yet stationary</td>
<td>Increase the time of the rest period before the EIS measurement</td>
</tr>
<tr>
<td>High NSR</td>
<td>Your output signal is too small</td>
<td>Increase the perturbation amplitude of the input signal</td>
</tr>
</tbody>
</table>

---

**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 100 A can be used with each channel in the VSP.

---

**Applications**

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

---

**How to make reliable EIS measurements**

Three quality indicators are available in EC-Lab® to ensure the reliability of EIS measurements.
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-150, VSP or VMP3 potentiostats/galvanostats, the FlexP brings unparalleled electrochemical knowledge and methodology to high-power applications.

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

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

Internal & external Boosters

Deliver more power to your application

SP-150, VSP and VMP3 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 17).

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 VMP3 potentiostat boards (with EIS option) when not connected to the booster portion of the unit.

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

• Fuel cell/Electrolyzer
• Photovoltaic systems
• Supercapacitors
• Electroplating
• 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 ever as good as your software. With 20 years of constant development, EC-Lab, BioLogic’s proprietary, patented software has become the benchmark for potentiostat control software.

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.

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.

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.

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. 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. They 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 EEEE) electron transfer. Electron transfer reactions can also be mixed with chemical reactions to simulate an EC mechanism.
## Detailed Specification

### Channel Specifications

<table>
<thead>
<tr>
<th>Premium</th>
<th>Essential</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIS capability</td>
<td>10 µHz to 7 MHz</td>
</tr>
<tr>
<td>EIS quality indicators</td>
<td>yes</td>
</tr>
<tr>
<td>Analog Ramp Generator</td>
<td>yes</td>
</tr>
<tr>
<td>Potentiostat bandwidth</td>
<td>8 MHz</td>
</tr>
<tr>
<td>Potentiostat rise/fall time</td>
<td>&lt; 500 ns</td>
</tr>
<tr>
<td>Acquisition time</td>
<td>12 µs (1 µs with ARG option)</td>
</tr>
<tr>
<td>Electrode connections</td>
<td>2, 3, 4, 5</td>
</tr>
<tr>
<td>IR compensation</td>
<td>manual, EIS, current interrupt (software)</td>
</tr>
<tr>
<td>Current</td>
<td>Maximum current</td>
</tr>
<tr>
<td>Current ranges</td>
<td>with standard board</td>
</tr>
<tr>
<td></td>
<td>with low current option</td>
</tr>
<tr>
<td></td>
<td>with low current option</td>
</tr>
<tr>
<td></td>
<td>with low current option</td>
</tr>
<tr>
<td>Current booster</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>External</td>
</tr>
<tr>
<td>Input impedance</td>
<td>1 TΩ (//10 pF), ULC: 100 TΩ (//20 pF)</td>
</tr>
<tr>
<td>Voltage</td>
<td>Compliance</td>
</tr>
<tr>
<td>Max applied potential</td>
<td>12 V</td>
</tr>
<tr>
<td>Resolution</td>
<td>±1 µV</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±1 µV</td>
</tr>
<tr>
<td>Range</td>
<td>25 V, 5 V, 3.3 V, 250 mV, ±500 mV</td>
</tr>
<tr>
<td>Maximum scan rate</td>
<td>200 V/s</td>
</tr>
<tr>
<td>Control amplifier</td>
<td>Potentiostat bandwidth</td>
</tr>
<tr>
<td></td>
<td>Potentiostat rise/fall time</td>
</tr>
<tr>
<td>General</td>
<td>I/O (analog/TTL)</td>
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<tr>
<td></td>
<td>Interfaces</td>
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### Chassis Specifications

<table>
<thead>
<tr>
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<th>Essential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slots available</td>
<td>16</td>
</tr>
<tr>
<td>Dimension</td>
<td>209 x 136 x 372 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>3.9 kg</td>
</tr>
<tr>
<td>Power Requirement</td>
<td>110 W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Essential</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Slots available</td>
<td>16</td>
</tr>
<tr>
<td>Dimension</td>
<td>254 x 517 x 337 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>20 kg</td>
</tr>
<tr>
<td>Power Requirement</td>
<td>650 W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Premium</th>
<th>Essential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slots available</td>
<td>10</td>
</tr>
<tr>
<td>Dimension</td>
<td>205 x 410 x 225 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>7.5 kg</td>
</tr>
<tr>
<td>Power Requirement</td>
<td>350 W</td>
</tr>
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<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Slots available</td>
<td>6</td>
</tr>
<tr>
<td>Dimension</td>
<td>254 x 517 x 337 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>20 kg</td>
</tr>
<tr>
<td>Power Requirement</td>
<td>850 W</td>
</tr>
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</table>

### Applications

<table>
<thead>
<tr>
<th>Premium</th>
<th>Essential</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Essential</th>
<th></th>
</tr>
</thead>
</table>

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 16 - 17

---

**Premium SP-200 SP-240 SP-300 BP-300 VSP-300 VMP-300**

<table>
<thead>
<tr>
<th>Essential</th>
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</thead>
<tbody>
<tr>
<td>Slots available</td>
<td>10</td>
</tr>
<tr>
<td>Dimension</td>
<td>205 x 410 x 225 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>15 kg</td>
</tr>
<tr>
<td>Power Requirement</td>
<td>220 W</td>
</tr>
</tbody>
</table>

---

**Premium SP-50e SP-150e VSP SP-3e VMP-3e**

<table>
<thead>
<tr>
<th>Essential</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Slots available</td>
<td>6</td>
</tr>
<tr>
<td>Dimension</td>
<td>254 x 517 x 337 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>25 kg</td>
</tr>
<tr>
<td>Power Requirement</td>
<td>650 W</td>
</tr>
</tbody>
</table>
# Detailed Specifications

## Premium boosters

<table>
<thead>
<tr>
<th>Specifications</th>
<th>±1 A / ±56 V</th>
<th>±2 A / ±30 V</th>
<th>±4 A / [–3; 14] V</th>
<th>±10 A / [–1; 6] V</th>
<th>±30 A / [0; 48] V</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current</strong></td>
<td>±1 A</td>
<td>±2 A</td>
<td>±4 A</td>
<td>±10 A</td>
<td>±30 A</td>
</tr>
<tr>
<td><strong>Compliance</strong></td>
<td>±2 mA on 1 A range</td>
<td>±4 mA on 2 A range</td>
<td>±8 mA on 4 A range</td>
<td>±16 mA on 10 A range</td>
<td>±50 mA on 30 A range</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±2 mA on 1 A range</td>
<td>±4 mA on 2 A range</td>
<td>±8 mA on 4 A range</td>
<td>±16 mA on 10 A range</td>
<td>±50 mA on 30 A range</td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>±49 V</td>
<td>±30 V</td>
<td>±3 V + 1 V</td>
<td>±1 V + 8 V</td>
<td>±1 V + 48 V</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>±49 V</td>
<td>±30 V</td>
<td>±3 V + 1 V</td>
<td>±1 V + 8 V</td>
<td>±1 V + 48 V</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIS frequencies</td>
<td>2 MHz – 10 µHz</td>
<td>1 MHz – 10 µHz</td>
<td>1 MHz – 10 µHz</td>
<td>1 MHz – 10 µHz</td>
<td>500 kHz – 10 µHz</td>
</tr>
<tr>
<td>Slew rate (no load)</td>
<td>±15 V/µs</td>
<td>±3 V/µs</td>
<td>±5 V/µs</td>
<td>±10 V/µs</td>
<td>±20 V/µs</td>
</tr>
<tr>
<td>Rise/fall time (no load)</td>
<td>±250 ns</td>
<td>±250 ns</td>
<td>±250 ns</td>
<td>±250 ns</td>
<td>±3 µs</td>
</tr>
<tr>
<td>Floating mode</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Parallel ability</td>
<td>no (yes with new version)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes up to 4</td>
</tr>
<tr>
<td>Connection</td>
<td>2, 3, 4, 5 leads</td>
<td>2, 3, 4, 5 leads</td>
<td>2, 3, 4, 5 leads</td>
<td>2, 3, 4, 5 leads</td>
<td>2, 3, 4 leads</td>
</tr>
</tbody>
</table>

## Essential boosters

<table>
<thead>
<tr>
<th>Specifications</th>
<th>2 / 4 / 5 A</th>
<th>10 / 20 A</th>
<th>80 A / HCP-803</th>
<th>100 A / HCP-1005</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current</strong></td>
<td>±2 A / ±12 A</td>
<td>±10 A / ±10 A</td>
<td>±80 A</td>
<td>±100 A</td>
</tr>
<tr>
<td><strong>Compliance</strong></td>
<td>±2 mA on 2 A range</td>
<td>±4 mA on 4 A range</td>
<td>±8 mA on 4 A range</td>
<td>±16 mA on 10 A range</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±2 mA on 2 A range</td>
<td>±4 mA on 4 A range</td>
<td>±8 mA on 4 A range</td>
<td>±16 mA on 10 A range</td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>adjustable ±10 V range</td>
<td>adjustable ±10 V range</td>
<td>±3 V</td>
<td>±3 / 5 V</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>±120 V</td>
<td>±120 V</td>
<td>±20 V</td>
<td>±10 V</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIS frequencies</td>
<td>2 A: up to 150 kHz, 4 A: up to 130 kHz, 5 A: up to 120 kHz</td>
<td>10 A: up to 80 kHz, 20 A: up to 80 kHz</td>
<td>1 MHz</td>
<td>1 MHz</td>
</tr>
<tr>
<td>Slew rate (no load)</td>
<td>±5 µV/µs</td>
<td>±5 µV/µs</td>
<td>±10 µV/µs</td>
<td>±20 µV/µs</td>
</tr>
<tr>
<td>Rise time and fall time (no load)</td>
<td>&lt; 10 µs</td>
<td>&lt; 20 µs</td>
<td>25 µs to 60 µs</td>
<td>95 µs to 1.7 ms</td>
</tr>
<tr>
<td>Parallel ability</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Connection</td>
<td>2, 3, 4, 5 terminal leads</td>
<td>2, 3, 4, 5 terminal leads</td>
<td>2, 3, 4, 5 terminal leads</td>
<td>2, 3, 4, 5 terminal leads</td>
</tr>
</tbody>
</table>

## General

<table>
<thead>
<tr>
<th>FlexP 0040</th>
<th>FlexP 0012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current</strong></td>
<td>50 A up to 200 A (4 in parallel)</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±0.2% of value ±0.1% FSR</td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>±50 A / ±58 V (water cooled)</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>10 kHz</td>
</tr>
<tr>
<td><strong>Parallel ability</strong></td>
<td>yes up to 4</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>2, 3, 4 terminal leads</td>
</tr>
</tbody>
</table>

## FlexP 0012

<table>
<thead>
<tr>
<th>General</th>
<th>security to open circuit (TTL level)</th>
<th>security to open circuit (TTL level)</th>
<th>Emergency push button</th>
<th>Security to open circuit (TTL level)</th>
<th>Emergency push button</th>
</tr>
</thead>
</table>

---

*Note: The specifications provided are not exhaustive and may vary depending on the specific model and configuration.*
Battery Test Stations & Cyclers

A full range of battery testers

Depending on your application, your requirements for battery/supercapacitor testing can be different (reference electrode required or not, sampling, maximum frequency for EIS, number of channels, etc). BioLogic offers a wide range of testing solutions to match your needs.

For advanced research measurements, BioLogic potentiostats/galvanostats are the right choice.

The BCS-800 series offers the best in-class performance of any battery cycler with optional EIS and up to 128 channels in a single cabinet. This high specification and versatility makes it the ideal solution for advanced high-throughput measurements as well as common, everyday battery cycling procedures.

The MPG-200 series is an intermediary solution. It offers research grade battery testing and can be provided in a rack, with a maximum of 80 channels to perform many tests simultaneously. Each channel is an independent potentiostat / galvanostat.

How to choose your battery tester?

<table>
<thead>
<tr>
<th>VMP3/VMP-300</th>
<th>MPG-200 series</th>
<th>BCS-800 series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>High-end research</td>
<td>Research development</td>
</tr>
<tr>
<td>Current ranges</td>
<td>10 µA - 150 A</td>
<td>10 µA - 5 A</td>
</tr>
<tr>
<td>Voltage range</td>
<td>±10 V</td>
<td>±10 V</td>
</tr>
<tr>
<td>EIS frequency range</td>
<td>7 MHz - 10 µHz</td>
<td>100 kHz - 10 µHz</td>
</tr>
<tr>
<td>Built-in EIS</td>
<td>Yes, on each channel with ARG option</td>
<td>Yes, on each channel</td>
</tr>
<tr>
<td>Acquisition time</td>
<td>200 µs</td>
<td>200 µs</td>
</tr>
<tr>
<td>Electrode connection</td>
<td>2,3-electrode/4-points measurement with CE measurement</td>
<td>3-electrode/5-points measurement</td>
</tr>
<tr>
<td>HPC measurement</td>
<td>Yes, down to 6 ppm</td>
<td>Yes, down to 6 ppm</td>
</tr>
<tr>
<td>Channels/module</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Max Channels/cabinet</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

Options

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

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

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 VMP3 or MPG-200 instruments from one session.
**BCS-800 series**

**Battery cycling test stations**

Each BCS-800 module is made up of 8 channels. To ensure better accuracy in current control and measurement, 5 current ranges are available depending on the model.

BCS-815 modules can be connected in parallel to increase the maximum current up to 120 A. With an 18-bit analog to digital converter for the voltage measurement, the resolution of the BCS-800 is an impressive 40 µV.

EIS-capable modules provide EIS over a frequency range from 10 kHz to 10 mHz for accurate and fast determination of internal battery resistance on every channel.

BCS-800 modules can be added to a single cabinet. Several sizes are offered (38U, 24U, 12U and 6U).

### Specifications
- Optional high quality EIS. Full scan from 10 kHz to 10 mHz
- 18-bit A/D converter (40 µV resolution)
- HPC measurement down to 6 ppm
- Modularity from few µA to 120 A
- Voltage measurement from 0 V to 10 V
- Module mixing (BCS-805/810/815)
- 2 ms acquisition time
- Several cabinet sizes
- Plug-and-play module installation

### Options
- **Connection:**
  - Cell cable from 25 cm to 10 m
  - CCH-1xx Coin cell holder
  - BH-1i Cylindrical battery holder
  - CCH-8 8 positions coin cell holder
  - CC8 Current collector to set parallel mode (up to ±120 A)
- **Cabinet:**
  - Rolling cabinet (38U, 24U)
  - Benchtop cabinet (12U, 6U)

### BT-Lab®

**An interface specifically designed for battery testing**

BT-Lab® software offers great usability and flexibility for battery cycling. The powerful «ModuloBat» sequence builder offers 15 control modes for easy programming of unique sequences, while the interface is informative and simple, simultaneously showing the experiment parameters and the corresponding graph of each selected channel.

### Global view

All channels can be viewed simultaneously on an advanced global view. The status of each channel is displayed with different colors to give quick, informative, and visual indicators. The time, current, voltage and charge values can be all displayed simultaneously.

### Comprehensive graphic and analysis package

The BT-Lab® graphic package is embedded in the software and includes powerful tools to create graph templates and analyze data. This package offers a unique trace filtering option by channel. This results in a multigraph window capable of displaying up to 128 graphs within a single window. With the advanced graph properties, the user can add and customize new variables for each axis. Powerful analysis tools (dQ/dV, HPC, etc) are also available in BT-Lab®.

### EIS capability

BT-Lab® software includes the capability for electrochemical impedance spectroscopy (EIS) measurement on every channel of BCS-capable modules, in a frequency range of 10 kHz to 10 mHz both in potentiostatic and galvanostatic modes. A drift correction option is available to correct the voltage drift of the battery during the EIS measurement.

**BT-Lab® provided with...**

BCS-805, BCS-810, BCS-815

---

**ModuloBat**

- 15 control modes
  - Constant Current/Voltage/Power/Resistance
  - Voltage/Current Scan
  - Galvano/Potentio EIS
  - DCIR
  - Galvano/Potentio ACIR
  - Current Interrupt
  - Rest/Loop
  - Urban Profile Import

- Up to 100 sequences
- 3 limits per sequence
- 3 recording conditions per sequence
- Modify on the fly
Battery Test Stations & Cyclers

**Why impedance measurement for battery testing?**

The BCS-800 series, with its fast bandwidth controllers, offers both potentiometric and galvanometric control for EIS measurements in a 10 kHz to 10 mHz frequency range, with a user-specified number of data points and recorded frequency range. The user also controls the excitation amplitude. Impedance spectroscopy can be used as a standalone technique, but it can also be seamlessly incorporated into the ModuloBat technique to record the impedance spectrum of the battery, either in equilibrium or steady-state conditions. This means you not only can record a spectrum of the cell at a constant voltage, but also under a given galvanostatic load.

If there are sources of uncompensated inductance or capacitance in the cell, only a full-impedance spectrum can be a reliable measure of internal resistance through an automated spectrum fitting procedure.

The low frequency range of the spectrum is an invaluable source of information concerning Li+ diffusion within the electrolyte (separator), as well as porosity within electrodes and inside the active material particles.

18-bit resolution allows the recording of small-amplitude EIS on top of substantial DC currents with very high levels of accuracy.

### Specifications

<table>
<thead>
<tr>
<th>Channel</th>
<th>Channel</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Cell connection</td>
<td>2 or 4 or 5 terminal leads</td>
<td>2 or 4 or 5 terminal leads</td>
</tr>
</tbody>
</table>

### Cell control

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>BCS-805</th>
<th>BCS-810</th>
<th>BCS-815</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance V</td>
<td>±20 V</td>
<td>±20 V</td>
<td>±20 V</td>
</tr>
<tr>
<td>Compliance mA</td>
<td>±100 mA</td>
<td>±100 mA</td>
<td>±100 mA</td>
</tr>
<tr>
<td>Maximum potential V</td>
<td>±150 V</td>
<td>±150 V</td>
<td>±150 V</td>
</tr>
<tr>
<td>Maximum current mA</td>
<td>±5 A</td>
<td>±5 A</td>
<td>±5 A</td>
</tr>
<tr>
<td>Excitation resolution V</td>
<td>200 µV</td>
<td>200 µV</td>
<td>200 µV</td>
</tr>
<tr>
<td>Current resolution</td>
<td>±7% of FSR</td>
<td>±7% of FSR</td>
<td>±7% of FSR</td>
</tr>
<tr>
<td>Current accuracy</td>
<td>±0.1% of control</td>
<td>±0.1% of control</td>
<td>±0.1% of control</td>
</tr>
</tbody>
</table>

### Voltage measurement

<table>
<thead>
<tr>
<th>Voltage</th>
<th>BCS-805</th>
<th>BCS-810</th>
<th>BCS-815</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>±20 V</td>
<td>±20 V</td>
<td>±20 V</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.1% of control</td>
<td>±0.1% of control</td>
<td>±0.1% of control</td>
</tr>
</tbody>
</table>

### Current measurement

<table>
<thead>
<tr>
<th>Current</th>
<th>BCS-805</th>
<th>BCS-810</th>
<th>BCS-815</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>±100 mA</td>
<td>±100 mA</td>
<td>±100 mA</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.1% of FSR</td>
<td>±0.1% of FSR</td>
<td>±0.1% of FSR</td>
</tr>
</tbody>
</table>

### Power requirements

<table>
<thead>
<tr>
<th>Power requirement</th>
<th>BCS-805</th>
<th>BCS-810</th>
<th>BCS-815</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>350 W</td>
<td>860 W</td>
<td>1700 W</td>
</tr>
<tr>
<td>Current</td>
<td>±120 A</td>
<td>±250 A</td>
<td>±500 A</td>
</tr>
<tr>
<td>Efficiency</td>
<td>&lt; 0.05%</td>
<td>&lt; 0.05%</td>
<td>&lt; 0.05%</td>
</tr>
</tbody>
</table>

### Interface processes

- **Interface processes**
  - Internal resistance
  - Induction behavior
  - Internal resistance

### Analog in

<table>
<thead>
<tr>
<th>Analog in</th>
<th>BCS-805</th>
<th>BCS-810</th>
<th>BCS-815</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>±150 µV</td>
<td>±150 µV</td>
<td>±150 µV</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.1% of value</td>
<td>±0.1% of value</td>
<td>±0.1% of value</td>
</tr>
</tbody>
</table>

### Analog out

<table>
<thead>
<tr>
<th>Analog out</th>
<th>BCS-805</th>
<th>BCS-810</th>
<th>BCS-815</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>±150 µV</td>
<td>±150 µV</td>
<td>±150 µV</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.1% of value</td>
<td>±0.1% of value</td>
<td>±0.1% of value</td>
</tr>
</tbody>
</table>

### Cell connection

<table>
<thead>
<tr>
<th>Cell connection</th>
<th>BCS-805</th>
<th>BCS-810</th>
<th>BCS-815</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>4 terminal leads + Guard</td>
<td>4 terminal leads + Guard</td>
<td>4 terminal leads</td>
</tr>
</tbody>
</table>

### Cell control

<table>
<thead>
<tr>
<th>Cell control</th>
<th>BCS-805</th>
<th>BCS-810</th>
<th>BCS-815</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance V</td>
<td>±20 V</td>
<td>±20 V</td>
<td>±20 V</td>
</tr>
<tr>
<td>Compliance mA</td>
<td>±100 mA</td>
<td>±100 mA</td>
<td>±100 mA</td>
</tr>
<tr>
<td>Maximum potential V</td>
<td>±150 V</td>
<td>±150 V</td>
<td>±150 V</td>
</tr>
<tr>
<td>Maximum current mA</td>
<td>±5 A</td>
<td>±5 A</td>
<td>±5 A</td>
</tr>
<tr>
<td>Excitation resolution V</td>
<td>200 µV</td>
<td>200 µV</td>
<td>200 µV</td>
</tr>
<tr>
<td>Current resolution</td>
<td>±7% of FSR</td>
<td>±7% of FSR</td>
<td>±7% of FSR</td>
</tr>
<tr>
<td>Current accuracy</td>
<td>±0.1% of control</td>
<td>±0.1% of control</td>
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</tr>
</tbody>
</table>

### Voltage measurement

<table>
<thead>
<tr>
<th>Voltage</th>
<th>BCS-805</th>
<th>BCS-810</th>
<th>BCS-815</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>±20 V</td>
<td>±20 V</td>
<td>±20 V</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.1% of control</td>
<td>±0.1% of control</td>
<td>±0.1% of control</td>
</tr>
</tbody>
</table>

### Current measurement

<table>
<thead>
<tr>
<th>Current</th>
<th>BCS-805</th>
<th>BCS-810</th>
<th>BCS-815</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>±100 mA</td>
<td>±100 mA</td>
<td>±100 mA</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.1% of FSR</td>
<td>±0.1% of FSR</td>
<td>±0.1% of FSR</td>
</tr>
</tbody>
</table>

### Power requirements

<table>
<thead>
<tr>
<th>Power requirement</th>
<th>BCS-805</th>
<th>BCS-810</th>
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<td>350 W</td>
<td>860 W</td>
<td>1700 W</td>
</tr>
<tr>
<td>Current</td>
<td>±120 A</td>
<td>±250 A</td>
<td>±500 A</td>
</tr>
<tr>
<td>Efficiency</td>
<td>&lt; 0.05%</td>
<td>&lt; 0.05%</td>
<td>&lt; 0.05%</td>
</tr>
</tbody>
</table>

*n.a.: not available*
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 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, in-plane and through-plane, CESH sample holders 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: ±1%

Sample Holders
- HTSH-1100
  - Ф=25 mm RT to 1100 °C
  - Ф=12 mm Leak-tight up to 2 bar relative K-type thermocouple
  - Ф=0.3 mm K-type thermocouple leak-tight up to 2 bar relative
- CESH
  - In-plane -40 to 150 °C
  - Through-plane -40 to 150 °C
- HTCC
  - Platinized -50 to 180°C
  - Non-platinized

Temperature Control Unit
- HTF-1100
  - Operating Temp: RT to 1100 °C
  - Heating rate adjustable
- ITS
  - In-plane ITS -35 to 150 °C
  - Through-plane ITS -35 to 150 °C
  - Temperature accuracy: ±0.3 °C

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. Setpoint 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, G, Lp, W, Wp, Wpp, M, Mp, Mpp, G, Gp, Gpp).

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.
Scanning Workstation

Systems for localized electrochemistry measurement

The traditional potentiostat/galvanostat measures an average response of the electrode material and 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 smallest size features detectable and typical applications.

<table>
<thead>
<tr>
<th>Scanning techniques</th>
<th>Information</th>
<th>Resolution</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECM</td>
<td>reactivity, conductivity</td>
<td>probe size</td>
<td>bioelectrochemistry, corrosion, fuel cell/electrolyzer, batteries, catalysts, sensors</td>
</tr>
<tr>
<td>ac-SECM</td>
<td>reactivity, conductivity, or localized EIS (no mediator required)</td>
<td>probe size</td>
<td>bioelectrochemistry, corrosion, fuel cell/electrolyzer, batteries, catalysts, sensors</td>
</tr>
<tr>
<td>ic-SECM</td>
<td>topography and reactivity or conductivity or localized EIS</td>
<td>probe size</td>
<td>bioelectrochemistry, corrosion, fuel cell/electrolyzer, batteries, catalysts, sensors</td>
</tr>
<tr>
<td>LEIS</td>
<td>local impedance of the sample</td>
<td>hundreds of μm</td>
<td>corrosion, coatings, catalysts</td>
</tr>
<tr>
<td>SVP (SVET)</td>
<td>electrochemical activity</td>
<td>tens of μm</td>
<td>corrosion, coatings, catalysts, bio electrochemistry</td>
</tr>
<tr>
<td>SDS (SDC)</td>
<td>dc electrochemistry in a droplet of electrolyte</td>
<td>hundreds of μm</td>
<td>corrosion, coatings, catalysts, sensors</td>
</tr>
<tr>
<td>ac-SDS</td>
<td>impedance in a droplet of electrolyte</td>
<td>hundreds of μm</td>
<td>corrosion, coatings, catalysts, sensors</td>
</tr>
<tr>
<td>SKP</td>
<td>work function, difference / topography</td>
<td>probe size</td>
<td>corrosion, coatings, semi-conductors, catalysts, photovoltaics, sensors</td>
</tr>
<tr>
<td>OSP</td>
<td>topography</td>
<td>100 nm (Z) 30 μm (X &amp; Y)</td>
<td>any field, complementary to the above</td>
</tr>
</tbody>
</table>

The M470 is compatible with a large range of potentiostat / galvanostats:
- Single potentiostat: SP-200 and SP-240
- 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 local to the electrochemical cell, adjustable stands and brackets are provided which mount directly to the M470 base plate.
All scanning probe microscopy systems come with **lifetime 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.

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### 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.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Materials</th>
<th>Options / sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECM / ic-SECM</td>
<td>glass &amp; platinum, Ø 2 mm</td>
<td>1, 5, 10, 15, 25 µm or 100 µm</td>
</tr>
<tr>
<td>SECME</td>
<td>glass &amp; platinum, Ø 2 mm</td>
<td>1, 5, 10, 15, 25 µm or 100 µm</td>
</tr>
<tr>
<td>SECM</td>
<td>glass &amp; platinum, Ø 2 mm</td>
<td>1, 5, 10, 15, 25 µm or 100 µm</td>
</tr>
<tr>
<td>SVP (SVET)</td>
<td>glass &amp; platinum, Ø 2 mm</td>
<td>1, 5, 10, 15, 25 µm or 100 µm</td>
</tr>
<tr>
<td>SKP</td>
<td>glass &amp; platinum, Ø 2 mm</td>
<td>1, 5, 10, 15, 25 µm or 100 µm</td>
</tr>
<tr>
<td>SDS</td>
<td>glass &amp; platinum, Ø 2 mm</td>
<td>1, 5, 10, 15, 25 µm or 100 µm</td>
</tr>
</tbody>
</table>

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

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### Tools

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.

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### Specification

<table>
<thead>
<tr>
<th></th>
<th>M470</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of techniques</td>
<td>9</td>
</tr>
<tr>
<td>Modular upgradability</td>
<td>yes</td>
</tr>
<tr>
<td>Positioning resolution</td>
<td>20 nm</td>
</tr>
<tr>
<td>Scanning range</td>
<td>110 mm</td>
</tr>
<tr>
<td>Max. scan speed</td>
<td>10 mm/s</td>
</tr>
<tr>
<td>Peak positioning</td>
<td>up to 1000 pm</td>
</tr>
<tr>
<td>Potential range</td>
<td>±10 V</td>
</tr>
<tr>
<td>Current ranges</td>
<td>1 A to 100 pA</td>
</tr>
<tr>
<td>Analog to digital resolution</td>
<td>0.1 MHz to 3 MHz</td>
</tr>
<tr>
<td>Impedance range</td>
<td>10 µHz to 100 MHz</td>
</tr>
<tr>
<td>XMP 300 family compatibility</td>
<td>yes</td>
</tr>
<tr>
<td>Recommended probe sizes</td>
<td>10 µm</td>
</tr>
</tbody>
</table>
A wealth of scientific knowledge... BioLogic Learning Center

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- Fuel cells & electrolyzers
- Supercapacitors
- Photovoltaics
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- Sensors
- Corrosion

MATERIAL SCIENCE

With the largest, most comprehensive range of potentiostats available on the market and product lines for high-performance battery cyclers, impedance analyzers and scanning probe workstations, you will be sure to find a BioLogic instrument that suits your needs. Whatever, your field of interest.

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