BCS-8xx series

Powerful and flexible equipment for battery cycling

- High quality EIS: Full scan from 10 kHz to 10 mHz
- 18-bit A/D converter (40 µV resolution)
- HPC measurement down to 6.3 ppm
- Modularity from few µA to 120 A
- Voltage measurement from 0 V to 9 V
- Module mixing (BCS-805/810/815)
- Powerful interface
- 2 ms acquisition time
- Several cabinet sizes
- Plug and play module installation

BioLogic
Science Instruments

The **BCS-8xx series** battery cycling system

is a modular system that addresses the expanding needs of the industrial battery cycling market by providing superior specifications and capability for an investment that gives new meaning to exceptional value.

Bio-Logic SAS has over 25 years experience in the design of instruments dedicated to research on battery and intercalation compounds.
To build on that legacy, Bio-Logic has created the **BT-Lab®** product line to extend the general electrochemistry product range to address the more specific needs of the battery cycle testing markets.

Each **BCS-8xx** module is composed of 8 channels. To ensure better accuracy in current control and measurement, **5 current ranges** are available depending on the model. Channels of **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-8xx** is an impressive **40 µV**. To add even more capability and value, every channel in a module is EIS-capable over a frequency range from **10 kHz to 10 mHz** for accurate and fast determination of the battery internal resistance.

BCS-8xx modules can be added to a single cabinet. Several sizes are offered (38U, 24U, 12U and 6U). A communication module provides the individual control and data acquisition on all the channels simultaneously. Each channel within a module is fully independent from the others. With the Ethernet connection, each BCS cabinet can be connected to a Local Area Network where multiple users can then access the instrument(s) and follow the battery cycling from anywhere across the LAN. Another advantage is the easy backup of cycling data onto a LAN server.

Each channel of the **BCS-815/BCS-810** modules allows for temperature measurement with K-type thermocouples. Each **BCS-8xx** module also has an analog input/output for interfacing with external devices.
Battery tests can be performed accurately by a 4-point measurement.

Each **BCS-8xx** is controlled by **BT-Lab®** software. With more than 10 years of continual development, the **BT-Lab®** software platform is reliable, complete and well-adapted to battery cycle testing.

FEATURES
- Wide EIS scan range to characterize:
  - √ The battery **internal resistance** (alternative to Current Interrupt method) at high frequencies.
  - √ The **diffusion process** at low frequencies
- 18-bit converter (RMSE: 6.3 ppm) and CED tool to perform **HPC measurements** (short battery cycle duration).
- 5 current ranges with an automatic current ranging to optimize the current control and measurement.
- Acquisition time of 2 ms for **fast process** recording.
- Plug and play modules installation. Modules can be added while measurement is running.

OPTIONS
Connection:
- Cell cable from 25 cm to 10 m
- CCH-1xx Coin cell holder
- BH-1i Cylindrical battery holder
- CC8 Current collector to set parallel mode (up to +/-120 A)

Cabinet:
- Rolling cabinet (38U, 24U)
- Benchtop cabinet (12U, 6U)

An interface designed for battery testing

The **BT-Lab®** software offers great usability and flexibility for battery cycling. The powerful "ModuloBat" method offers 12 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.

On-board **firmware**

The firmware of the **BCS-8xx** is a stand-alone operating system. It is loaded into the instrument at the interface launch with hardware control completely autonomous while the experiment is running. **BT-Lab®** software is Windows-based, compatible with either 64-bit or 32-bit operating systems. It is also a multi-device system, able to control several modules simultaneously.

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 visual indicators. The time, current, voltage and charge values are all displayed on-line.

Powerful **method**

BT-Lab® software allows the user to define the critical parameters related to their batteries, such as the name, materials, and capacity in the "Battery cell characteristics" section. For experimental definition, the **ModuloBat** method can be composed of up to 100 different sequences. For any given sequence, the control mode can be selected from 12 mode options and different control modes can be easily linked.
The controlled current can also be defined as a function of the capacity rate of the cell, allowing the user to create more unique and flexible experiments.
To save time, each setup can be saved and reloaded on all selected channels simultaneously.
User can also use **advanced techniques** such as the popular GCPL technique that comes from our **EC-Lab®** research grade software.

Experiment and **safety** limits

In every sequence of ModuloBat, up to three experimental limits can be selected on measured values such as time, current, voltage, temperature, or on a variation of this value. Different, selectable actions may be taken when a limit is reached, such as "stop" the experiment or "go to the sequence N". Additionally, safety limits can be added on each channel to shut down the channel in the event something goes wrong during the experiment.
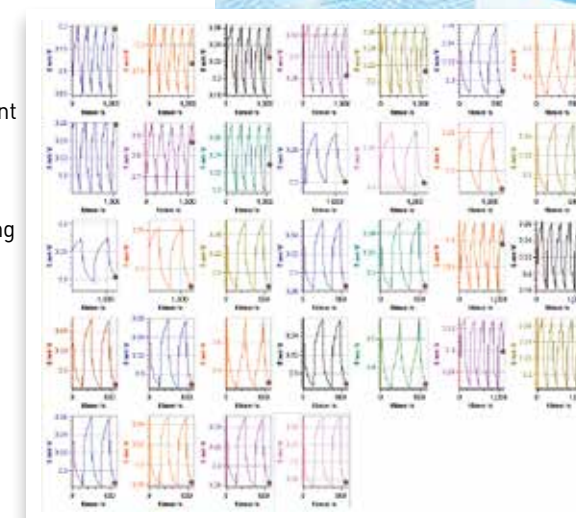
Intelligent recording conditions

Several recording conditions can be defined for an optimized amount of data points. Multiple recording conditions with "OR" commands are used to avoid missing any variation in the cell behavior during the data recording while also limiting the total data collected to reasonable volumes for faster analysis.

Comprehensive graphic package

The **BT-Lab®** graphic package is embedded with 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 (such as integral, circular or linear fit) are also available in **BT-Lab®**.

EIS capability

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

ModuloBat Focus
- **12 control modes**:
  - Constant Current/Voltage/Power/Resistance
  - Voltage/Current Scan
  - Galvano/Potentio EIS
  - Current Interrupt
  - Rest/Loop
  - Urban Profile Import

- **Up to 100 sequences**
- **3 limits per sequence**
- **3 recording conditions per sequence**

Specifications

MODULES

	BCS-805	BCS-810	BCS-815
Channels	8	8	8
Voltage			
Range	0 V to 10 V	0 V to 10 V	0 V to 9 V
Resolution control	150 µV	150 µV	150 µV
measurement	40 µV (18 bit)	40 µV (18 bit)	40 µV (18 bit)
Accuracy	< ±0.3 mV ±0.01% of setting	< ±0.3 mV ±0.01% of setting	< ±0.3 mV ±0.01% of setting
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
Resolution control	Down to 800 pA	Down to 8 nA	Down to 80 nA
measurement	Down to 0.2 nA (18 bit)	Down to 2 nA (18 bit)	Down to 20 nA (18 bit)
Accuracy	< 0.05% of setting ±0.01% of FSR	< 0.05% of setting ±0.01% of FSR	< 0.5% of setting ±0.01% of FSR (10 A range) < 0.05% of setting ±0.01% of FSR (others)
Parallel ability	no	no	Yes Up to ±120 A with 8 channels
EIS			
Built-in	On each module	On each module	On each module
Range	10 kHz - 10 mHz	10 kHz - 10 mHz	10 kHz - 10 mHz
Measurement			
Acquisition time	2 ms	2 ms	2 ms
Time base	2 ms	2 ms	2 ms
Additional measurement			
Thermocouple	NA	K Type on each channel -25 °C +200 °C with accuracy of ±2 °C	K Type on each channel -25 °C +200 °C with accuracy of ±2 °C
Analog in	1 (18 bit) on each module	1 (18 bit) on each module	1 (18 bit) on each module
Analog out	1 (16 bit) on each module	1 (16 bit) on each module	1 (16 bit) on each module
Cell connection			
	4 terminal leads + Guard	4 terminal leads + Guard	4 terminal leads
General			
Height	1U	2U	4U
Weight	5 kg	10 kg	23 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.
Cabinets of 38U, 24U, 12U and 6U are available.