

VSP/VMP3

Modular to address all
your electrochemical applications



APPLICATIONS

- Energy storage
- Sensors
- Fundamental Electrochemistry
- Corrosion/coating
- Fuel cell
- Photovoltaic cell
- Impedance measurement

VSP/VMP3

The **VSP/VMP3** are research-grade multichannel potentiostats/galvanostats.

Designed with a modular chassis, up to 16 independent potentiostat channels can be installed.

The **VSP/VMP3** are versatile, so they can be equipped with additional capability such as EIS, low or high current options.

The **VSP/VMP3** are controlled from a PC by a USB or an Ethernet connection. Using the Ethernet connection, the **VSP/VMP3** can be installed on a Local Area Network to allow multiple users to access the instrument and follow the measurement from anywhere.

Thanks to its unique CE-to-Ground connection mode, **VSP/VMP3** can also be used for multielectrode experiments.

Moreover, voltages and impedances of the working (eg positive electrode of battery) and counter electrodes (eg negative electrode of battery) can be measured simultaneously.

Each channel has two analog inputs and one analog output to manage external instruments, such as a rotating electrode, or a quartz crystal microbalance, and record the generated data.

The **VSP/VMP3** are supplied with **EC-Lab®** software. With over 80 techniques that can be sequenced, and with a variety of analysis tools, including EIS modelling with Levenberg-Marquardt and Simplex algorithms.

The **VSP/VMP3** are a complete research grade multichannel workstations.



FEATURES

- Current ranging from 1 nA up to 400 mA (76 fA with low current option)
- 20 V adjustable reference voltage
- Resolution: 300 μ V programmable down to 5 μ V by adjusting the dynamic range
- Acquisition time: 200 μ s with EC-Lab® (20 μ s with EC-Lab® Express)
- Simultaneous EIS measurement on WE and CE
- CE-to-Ground mode to perform experiments with several working electrodes, one counter and one reference electrode.
- Stack modes
- Switching time galvano/potential: 10 μ s

OPTIONS

- Built-in EIS option (1 MHz to 10 μ Hz) on each channel
- Low-current option (1 nA) need extra module (use 1 slot)
- Up to 16/5 independent channels for VMP3/VSP respectively
- External boosters available from 2 A up to 100 A
- Load boxes (50 V/150 A)
- SAM-50 (50 V) for stack measurement (VMP3 only).

EC-Lab® is the result of more than 15 years of continuous development.

Versatile and powerful control interface

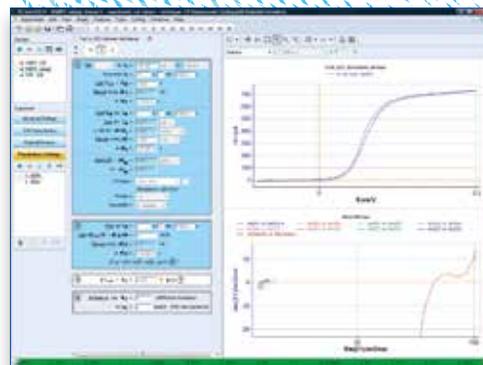
Over 80 techniques are available. The user can also create new protocols with the “technique builder”. Two view modes are available in flow charts and in columns. Most of parameters can be modified during the run, with the changes stored into the raw data file. Moreover, the management of the buffer makes the data transfer safer.

Techniques

■ Voltammetry:	OCV, CV, CVA, CA, CP, SV, LASV, ACV, LSV
■ Impedance (option):	GEIS, PEIS, SGEIS, SPEIS (Mott-Schottky), PEISW
■ Pulsed:	DPV, SWV, DPA, DNPV, NPV, RNPV
■ Ohmic drop determination:	MIR, ZIR, Current Interrupt
■ Battery:	GCPL (1 to 7), PCGA, CLD, CPW, APGC, Urban cycle simulation, ModuloBat, BCD, CED
■ Corrosion:	Linear and Cyclic Polarization, Generalised Corrosion, Pitting, ZRA, ZVC, Corrosimetry, VASP, CASP
■ Fuel/photovoltaic cell:	I-V characterization, CLD, CPW
■ Supercapacitor:	CV, C st Current, C st Voltage
■ Technique builder:	Modular Potentio/Galvano, Loop, Trigger in/out, Wait, RDEC, Ext App, Send email

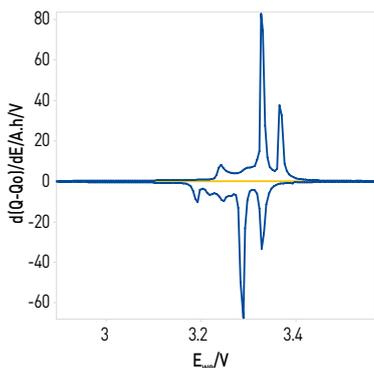
Display

Active data can be shown in multiple graph windows, each with a double y-axis view. The axes (unit, scaling), color, style, and other graphic properties can be modified easily. The user can select multiple graph windows to show the active experiment while analyzing previously stored data.



Simulation, analysis & fitting

Analysis tools (peak, convection wave, integral), with classical fits (linear, polynomial, circular) and processes are available. EIS modeling is included using the well known circuit descriptor code approach. More than 150 circuits with two minimization algorithms are available. The user can define and build his own circuit using a range of thirteen elements (R, C, L, La, Q, W, G, Ga, Gb, Wd, M, Ma, Mg). This tool is able to fit successive EIS data cycles.



General electrochemistry

- Peak Analysis...
- Wave Analysis...
- CV Fit/Sim...

EIS

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

Battery process

- Process data (capacity, efficiency, energy, dq/dE...)

Photovoltaic

- Photovoltaic analysis (fill factor, efficiency...)

Corrosion

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

Math

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

Specifications

CHANNEL BOARD

Cell control	
Connection	2, 3, 4 or 5 terminals (+ ground)
Compliance	20 V adjustable from ± 10 V to [0-20] V
Maximum current	± 400 mA continuous
Maximum potential resolution	300 μ V on 20 V programmable down to 5 μ V on 200 mV
Maximum current resolution	0.004% of the dynamic range 760 pA on the 10 μ A range
Accuracy (DC)	< 0.1% FSR*
Rise time	(10% - 90%) < 2 μ s (No load)
Acquisition time	20 μ s

Current measurement	
Ranges	automatic on every range ± 10 μ A to ± 1 A (7 ranges)
Maximum resolution	0.004% of the range, 760 pA on the 10 μ A range
Acquisition speed	200,000 samples/second
Accuracy (DC)	< 0.1% FSR*

LOW CURRENT option

Cell control	
Maximum current	± 100 mA continuous
Maximum current resolution	0.004% of the dynamic range, programmable: 76 fA on the 1 nA range
Applied current accuracy	< 1% FSR* on the 1 nA range < 0.5% FSR* on the 10 nA range < 0.1% FSR* on the other ranges

Potential measurement	
Ranges	± 2.5 V, ± 5 V, ± 10 V, ± 10 V adjustable
Maximum resolution	0.0015% FSR*, down to 75 μ V
Acquisition speed	200,000 samples/second
Accuracy (DC)	< 0.1% FSR*

Electrometer	
Inputs	3 potential measurements
Impedance	$> 10^{12} \Omega // < 20$ pF
Bias current	< 5 pA

Impedance (option)	
Frequency range	1 MHz to 10 μ Hz (accuracy: 1%, 1°)
Amplitude	potentio: 1 mVpp to 1 Vpp galvano: 0.1% to 50% of the current range

Additional inputs/outputs	
2 analog inputs	16-bit resolution with automatic ± 2.5 V, ± 5 V, ± 10 V ranges
1 analog output	± 10 V 16-bit resolution
1 external trigger	TTL level (1 input / 1 output)

CURRENT BOOSTERS option

Cell control		2/4/5 A
Compliance		adjustable ± 10 V range
Maximum current		2 A: ± 2 A, 4 A: ± 4 A, 5 A: ± 5 A
Maximum potential		± 20 V
Rise time and fall time	potentio: 15 μ s galvano: 40 μ s	
Measurement		
Current 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

Electrometer		10/20 A	80/100 A
Bandwidth		1 MHz	1 MHz
EIS			
Max frequency (accuracy 1%, 1°)		2 A: up to 150 kHz, 4 A: up to 130 kHz 5 A: up to 120 kHz	80 A: up to 15 kHz, 100 A: up to 10 kHz
Amplitude	potentio: 0.5 mV to 0.5 V galvano: 0.1% to 50% of the current range	0.5 mV to 0.5 V 0.1% to 50% of the current range	0.5 mV to 0.5 V 0.1% to 50% of the current range

Current measurement		10/20 A	80/100 A
Ranges		± 1 nA, ± 10 nA, ± 100 nA, ± 1 μ A	
Maximum resolution		0.004% of the range down to 76 fA	
Accuracy		< 1% FSR* on the 1 nA range < 0.5% FSR* on the 10 nA range < 0.1% FSR* on the other ranges	
Electrometer			
Impedance		$10^{14} \Omega // 1$ pF	
Bias current		60 fA typical, 150 fA max at 25 °C	
Bandwidth		1 MHz	

CHASSIS

VSP	
Dimensions (W x D x H)	435 x 335 x 95 mm
Weight	8 kg
Power	90-264 V, 47-440 Hz
Slots	5

VMP3		External booster	
Dimensions (W x D x H)	495 x 465 x 260 mm	495 x 465 x 284 mm	
Weight	20 kg	24 kg	
Power	90-264 V, 47-440 Hz	90-264 V, 47-440 Hz	
Slots	16	4	

* FSR: Full Scale Range
Specifications subject to change



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