PalmSens
Compact Electrochemical Interfaces

EmStat3 and 3+™
potentiostats

Rev. 11-2018

Contents

EmStat3 and 3+ (Blue) potentiostats

The EmStat and EmStat Blue instrument series are the smallest electrochemical interfaces available on the market. The devices are general purpose potentiostats but are also available as separate module for OEM use in specific applications.
EmStat is always shipped in a rugged carrying case. See also page 6.

Differences between regular EmStat model and EmStat Blue model

	EmStat3 and 3+™ 	EmStat3 and 3+ blue 
Size (cm)	6.7 x 5.0 x 2.8	10.0 x 6.0 x 3.4
Weight	85 g	250 g
Battery	no	yes
Communication	USB	USB + Bluetooth
Auxiliary port	no	yes
Sensor connector	LEMO	LEMO + SPE[1]

See page 6 for system specifications.

software for Windows and Android

PSTrace for Windows provides support for all techniques and device functionalities.
PSTouch for Android supports all techniques supported by EmStat.

Minimum PC requirements for PSTrace:
-Windows XP, Vista, 7, 8, or 10 (32-bit or 64-bit)
-1 gigahertz (GHz) or faster 32-bit (x86) or 64-bit (x64) processor
-1 gigabyte (GB) RAM (32-bit) or 2 GB RAM (64-bit).

See for more information: www.palmsens.com/software

[1] The SPE connector allows for direct insertion of the most popular types of Screen Printed Electrodes.

Supported techniques

The following techniques are supported by the EmStat series:

Voltammetric techniques

▪ Linear Sweep Voltammetry	LSV
▪ Differential Pulse Voltammetry	DPV
▪ Square Wave Voltammetry	SWV
▪ Normal Pulse Voltammetry	NPV
▪ Cyclic Voltammetry	CV

The above mentioned techniques can also be used for stripping voltammetry.

Techniques as a function of time

▪ Amperometric Detection / Chronoamperometry	AD CA
▪ Chronocoulometry	CC
▪ Pulsed Amperometric Detection	PAD
▪ Multiple Pulse Amperometric Detection	MPAD
▪ Open Circuit Potentiometry	OCP
▪ Multistep Amperometry	MA

The current is measured using a **zero resistance ammeter** (ZRA).

Where possible, the electrochemical techniques can be applied using **auto ranging** which means that the instrument automatically sets the optimal current range. The user can specify a highest and lowest current range in which the most appropriate range is selected automatically.

See page 5 for system specifications.

Specifications of general parameters

General pretreatment
Apply conditioning, deposition or begin potential for: 0 – 1600 s

General voltammetric parameters

Potential range for EmStat3:	-3.000 V to +3.000 V
Potential range for EmStat3+:	-4.000 V to +4.000 V
Step potential:	0.125 mV to 250 mV
Pulse potential:	0.125 mV to 250 mV

Limits of some technique specific parameters for EmStat3 and EmStat3+

NPV and DPV:	Scan rate: Pulse time:	0.025 mV/s (0.125 mV step) to 50 mV/s (5 mV step) 5 ms to 300 ms
SWV[1]:	Frequency:	1 Hz to 500 Hz [1]
LSV and CV:	Scan rate:	0.01 mV/s (0.1 mV step) to 5 V/s (5 mV step)
AD:	Interval time: Run time:	1 ms to 300 s 1 s to hours
PAD:	Interval time: Pulse time: Run time:	50 ms to 300 s 1 ms to 1 s 10 s to hours
MPAD:	Pulse times: Run time: Number of potential levels:	100 ms to 2 s 10 s to hours 3
Potentiometry at open circuit (OCP):	Interval time: Maximum run time:	1 ms to 30 s hours
Multistep Amperometry:	Interval time: Number of potential levels: Number of cycles: Maximum run time:	1 ms to 30 s 1 to 255 1 to 20000 hours

[1] *PSTrace provides the option to measure forward and reverse currents separately.*
Note: some limits of parameters are set for practical reasons and can be modified on request.

System specifications

	EmStat3™	EmStat3+™
▪ dc-potential range	± 3.000 V	± 4.000 V
▪ compliance voltage	± 5 V	± 8 V
▪ applied dc-potential resolution	0.1 mV	0.125 mV
▪ applied potential accuracy	≤ 0.2 % max. 2 mV offset	≤ 0.3 % max. 3 mV offset
▪ meas. potential resolution	1 mV	1 mV
▪ meas. potential accuracy	≤ 0.1 %, max 2 mV offset	≤ 0.1 %, max 2 mV offset
▪ current ranges	1 nA to 10 mA (8 ranges)	1 nA to 100 mA (9 ranges)
▪ maximum measured current	± 20 mA typical and ± 15 mA minimum	± 100 mA typical

EmStat 3 and 3+	
▪ current resolution	0.1 % of current range 1 pA on lowest current range
▪ current accuracy	≤ 1 % of current range at 1 nA ≤ 0.5 % at 10 nA ≤ 0.2 % at 100 nA to 100 uA ≤ 0.5 % at 1 mA, 10 mA and 100 mA all with max. 0.2 % offset error
▪ electrometer amplifier input	> 100 Gohm // 4 pF
▪ rise time	approx. 100 µs
▪ sensor connection	shielded cable with circular connector for WE, RE, CE and Sense[2]

EmStat 3 and 3+ regular model	
▪ housing	anodized aluminium: 6.7 cm x 5.0 cm x (1.9 to 2.8 cm)
▪ weight	85 g
▪ power supply	USB 5 V, min. 130 mA (ES3) or 500 mA (ES3+)
▪ communication	USB
▪ auxiliary port	not present

EmStat 3 and 3+ Blue model	
▪ housing	anodized aluminium: 100 mm x 60 mm x (27 to 34 mm)
▪ weight	250 g
▪ temperature range	0° C to +40° C
▪ power supply	USB or internal Li-Po battery 5 V, min. 130 mA (ES3) or 500 mA (ES3+)
▪ battery life	> 6 hours, connected via Bluetooth, cell on at 1mA current can be extended to >24 hours with external power bank full battery charge takes approx. 3 hours
▪ communication	USB or Bluetooth
▪ auxiliary port	D-Sub15 (female DE-15) with following pins available: - analog input and output (0 - 4.096 V, 12 bit) - 4 digital outputs, 1 digital input (5 V) - Rx / Tx (TTL) - 5 V output (max. 50 mA), digital and analog ground

[2] *Only available for EmStat3+ to be used with 100 mA range.*

Standard EmStat configuration

The Emstat regular model comes in a carrying case size 230 x 200 x 50 mm.
The case includes:

- EmStat3 or EmStat3+
- Mini-USB cable
- Sensor cable
- Croc clips
- Test sensor

Also included:

- PSTrace software + manual
- Quick start document

Standard EmStat Blue configuration

The Emstat Blue model comes in a carrying case size 230 x 200 x 70 mm.
The case includes:

- EmStat 3 or 3+ Blue
- Mini-USB cable
- Sensor cable
- Croc clips
- Test sensor

Also included:

- PSTrace software + manual
- Quick start document

Optional:

- 7” tablet
- Tablet charger

EmStat3 Blue in standard carrying case showing optional tablet

EmStat Blue accessories

The following accessories can be used with the auxiliary port present on the EmStat Blue.

MUX8-R2 also available with integrated Emstat3 or 3+ potentiostat

MUX8-R2 or MUX16 multiplexer

The MUX8-R2 is a multiplexer for use with 2 to 8 sensors or three-electrode cells. It is connected to the EmStat Blue instrument. This device allows application of sensor arrays with up to eight working electrodes sharing the reference and counter electrodes, but also with eight working, eight counter and eight reference electrodes. The device can also be used with two-electrode sensor arrays.

The MUX16 is a multiplexer for use with 16 working electrodes all sharing the same counter and same reference electrode in a single solution or for 16 working electrodes each with a combined reference/counter electrode in separate solutions.

Magnetic stirrer

The magnetic stirrer controlled by EmStat Blue is ideal for stripping analysis applications. The stirrer is switched on during the conditioning and deposition stages by means of the Switchbox.

LM35 temperature sensor

This temperature sensor allows for monitoring of temperature during an experiment.
Two point calibration allows the user to precisely calibrate the sensor for the required temperature range. The calibration curve shows a linear slope of +10 mV/°C with 0.5°C Ensured Accuracy (at 25°C). It is rated for full 2°C to 150°C range. The sensor has low self-heating (0.08°C in still air).

Differential Electrometer Amplifier (DEA)

The Differential Electrometer Amplifier (DEA) is a general purpose input amplifier. It can be used as a floating voltage amplifier with differential input and single output to the auxiliary port of EmStat Blue.

Default range is -5V to 5V (1x gain). Possible gains are: 2x, 5x, 10x, 20x, 50x, 100x, etc.

EmStat: Embedded Potentiostat for OEM purposes

EmStat as OEM module

The EmStat PCB's are also available as bare module for OEM purposes.

See for more information:
http://www.palmsens.com/en/embedded-oem/

Please do not hesitate to contact PalmSens for more details:
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