EmStat MUX8-R2 ™

POTENTIOSTAT WITH INTEGRATED MULTIPLEXER

PalmSens

Rev. 11-2020-007

Contents

PalmSens

Description

The EmStatMUX8-R2 potentiostat with multiplexer is designed for up to 8 channels with 2- or 3-electrode sensors or cells. The instrument consists of the MUX8-R2 multiplexer with an integrated EmStat3 or EmStat3+ potentiostat. Specifications can be found on page 8.

Stacking up to 128 channels

The EmStatMUX8-R2 has a Link connector which can be used to daisy chain to a MUX8-R2 multiplexer, expanding the number of channels. A maximum of 16 multiplexers can be connected in a daisy chain, giving a maximum of 128 channels.
The PSTrace software detects automatically how many multiplexers are daisy chained and shows the available number of channels in the user interface.

See page 11 for more information about PSTrace.

Magnetic feet for easy stacking

PalmSens

Configurations

The EmStatMUX8-R2 multiplexer is designed for use up to 128 channels with 2- or 3- electrode sensors or cells.

The multiplexer can be used with different electrode or sensor configurations:

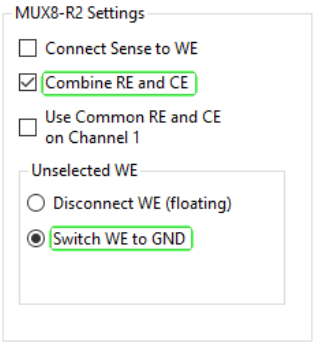
1. Eight separate cells or sensors each with a working/sense, reference and counter electrode
2. Eight separate cells or sensors each with a working/sense and combined reference and counter electrode
3. Cell or sensor array with eight working/sense electrodes sharing one reference and one counter electrode
4. Cell or sensor array with eight working/sense electrodes sharing one combined reference/counter electrode

In all configurations the cells can be multiplexed, leaving the non-selected working electrodes either at open circuit (individually floating) or at Ground potential.

When in configurations 3 and 4, the unselected channels are switched to Ground, they will have the working electrode's potential. This is due to the fact that the active WE is always at Ground potential.

You can easily change the hardware configuration of the MUX8-R2 as part of the measurement settings in our PSTrace software or the PStouch app for Android.

See page 11 for more information about PSTrace.



Hardware settings can be changed in the software

Connectors

The EmStatMUX8-R2 has the following connectors:

CONNECTOR	FUNCTION
INPUT	Y-cable connects to both potentiostat sensor connector and (digital) AUX
AUX	Can be used to measure auxiliary input like temperature or pH, and to switch or trigger external hardware using two digital control lines that can be set in PSTrace
LINK	Connects to Input of next multiplexer, for daisy-chaining multiple multiplexers.
USB-C	For connecting to PC or Android device
CHANNEL 1-4	Connects to sensor cables 1-4
CHANNEL 5-8	Connects to sensor cables 5-8

See next page for cable and cell connection options.

Cell Connections

Option A (default):
The channels are divided in two sets of four sensor cables joined with a D-Sub connector.

Order code: [CBL-MUX08R2-SNS-5S]

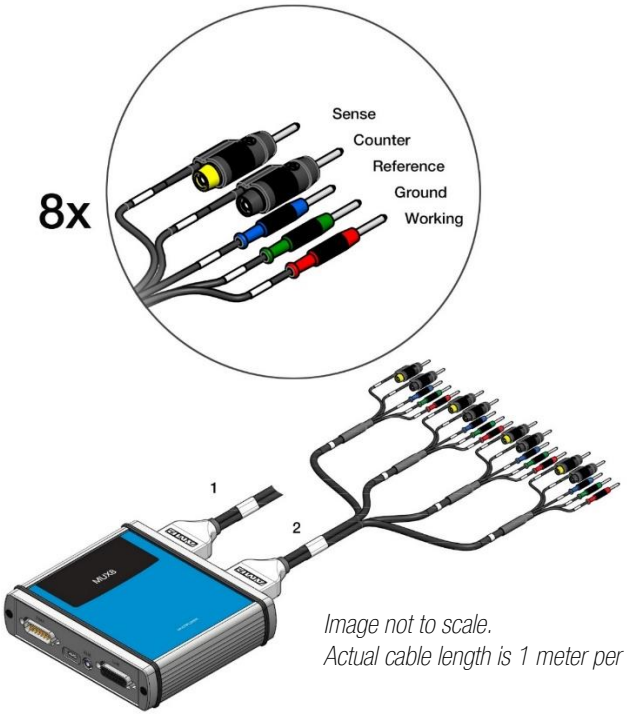


Image not to scale.
Actual cable length is 1 meter per channel.

Option B:
The cable here shown at the right can be used in case the multiplexer needs to be connected to a fixed setup by means of soldering or screw-terminals.

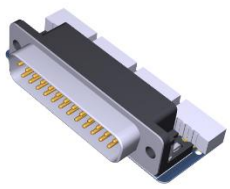
Order code: [CBL-HD-MUX08R2]

Option C:
You can also connect one or two screw-terminals directly in the multiplexer.

Order code: [MUX08R2-ST]

Option D:
The SPE adapter for our MUX8-R2 multiplexer allows you to connect 8x Screen Printed Electrodes (SPE's). The pitch of the SPE connector is 2.54 mm and compatible with the most popular brands of SPE's.

Order code: [MUX08R2-SPE]



Supported Switching Modes

In *sequential* mode each channel is set before the next measurement starts. In *alternating* mode, the channels are quickly scanned during each interval time giving a virtual-simultaneous measurement across the selected channels.

	Supported Switching Mode	
Voltammetric techniques:	**Sequentially**	**Alternatingly**
▪ Linear Sweep Voltammetry	✓	
▪ Cyclic Voltammetry	✓	
▪ Fast Cyclic Voltammetry	✓	
▪ AC Voltammetry	✓	
▪ Differential Pulse Voltammetry	✓	
Pulsed techniques:		
▪ Square Wave Voltammetry	✓	
▪ Normal Pulse Voltammetry	✓	
▪ Stripping Chronopotentiometry	✓	
Amperometric techniques		
▪ Chronoamperometry	✓	✓
▪ Zero Resistance Amperomery	✓	✓
▪ Multistep Amperometry	✓	
▪ Fast Amperometry	✓	
▪ Pulsed Amperometric Detection	✓	
▪ Multiple-Pulse Amperometric Detection	✓	
Galvanostatic techniques		
▪ Linear Sweep Potentiometry	✓	
▪ Chronopotentiometry	✓	✓
▪ Multistep Potentiometry	✓	
▪ Open Circuit Potentiometry	✓	✓
▪ Stripping Chronopotentiometry	✓	
Other		
▪ Mixed Mode	✓	
▪ Impedance Spectroscopy (EIS/GEIS)	✓	

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

	With potentiostat version EmStat3™	With potentiostat version 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 % with max. 2 mV offset error	≤ 0.3 % with max. 3 mV offset error
▪ 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

Potentiostat

▪ 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

▪ electrometer amplifier input	> 100 Gohm // 4 pF
▪ rise time	approx. 100 µs

Integrated MUX8-R2 Multiplexer

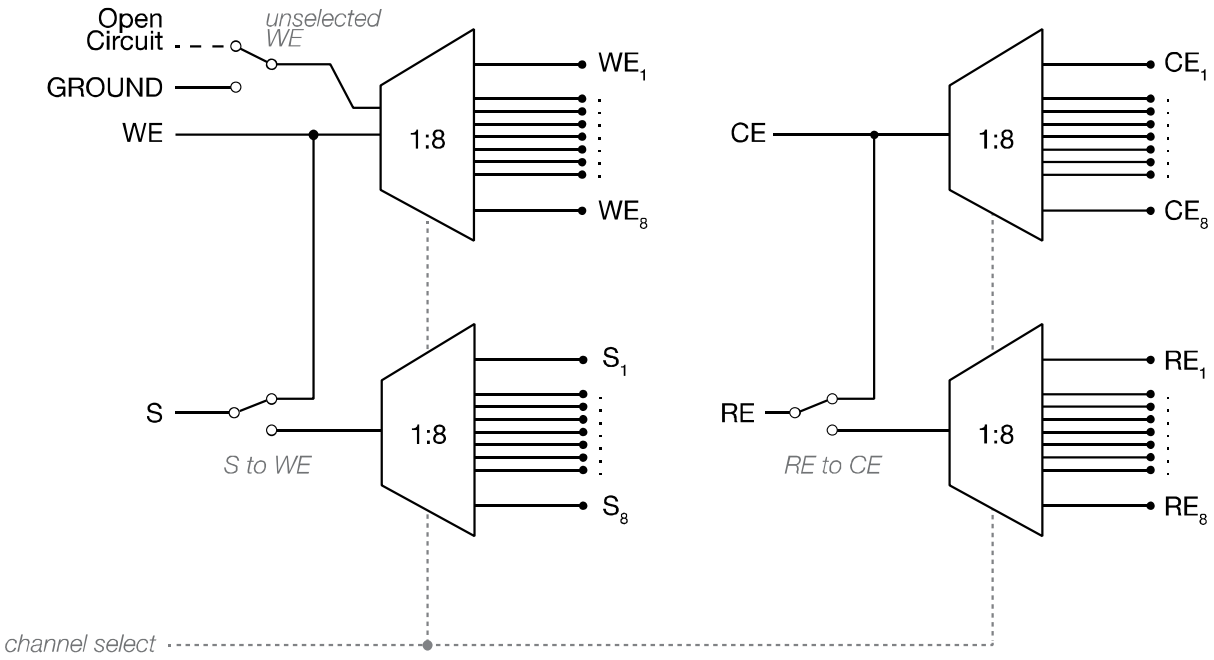
▪ number of channels	8 (up to 128 channels when daisy chained)
▪ multiplexer	switches 8 x (WE, S, RE and CE)
▪ on resistance for WE	1.5 ohm typical
▪ charge injection on WE	20 pC typical
▪ leakage current	< 20 pA (5 pA typical) at 25 °C
▪ switching time	2 ms

Other

▪ housing	aluminium: 138 mm x 121 mm x 37 mm
▪ weight	+/- 250 g
▪ temperature range	0° C to +40° C
▪ power supply	USB
▪ communication	USB-C

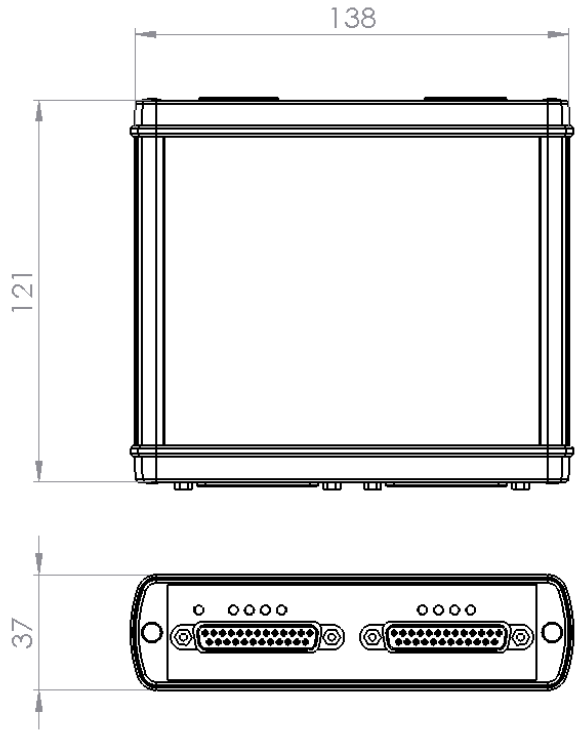
See page 5 for cable and cell connection options

Functional Diagram



Dimensions

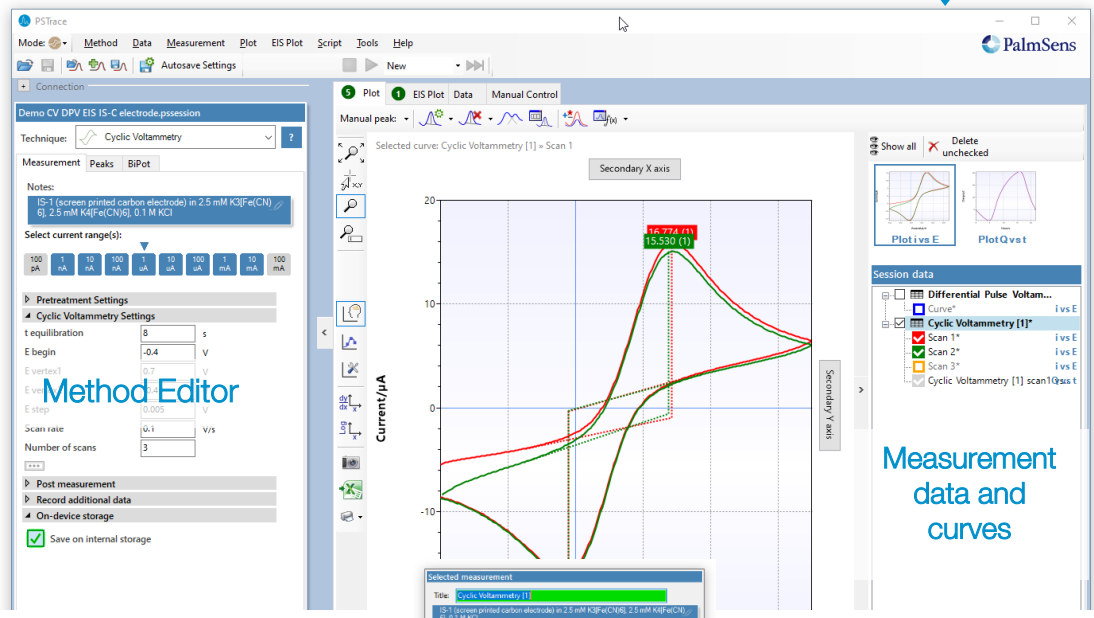
Dimensions in mm:



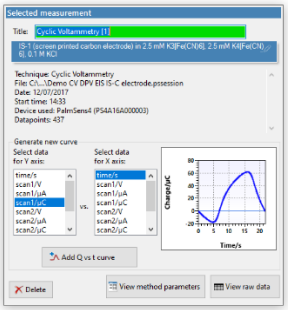
PSTrace: Software for Windows

Select current ranges for auto ranging and the starting current range.

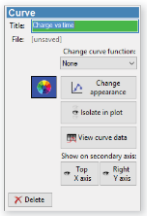
Switch between plots if curves with different units are available.



Click on a measurement in the legend to see the available data and to generate more curves.

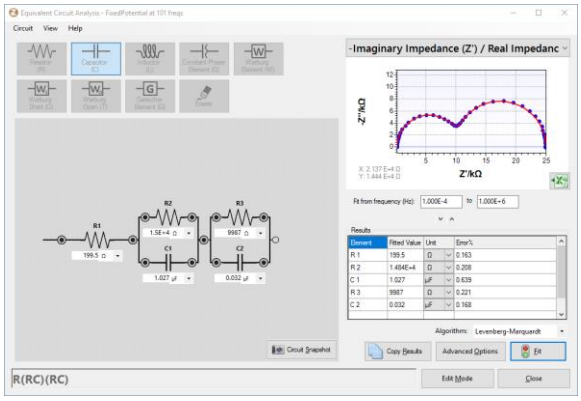


Click on a curve in the legend to change its title or appearance.



Other functions in PSTrace 5

- Equivalent Circuit Fitting
- Scripting
- Open your data in Origin and Excel with one click of a button
- Save all available curves, measurement data and methods to a single file
- Browse measurements on PalmSens4's internal storage
- Direct feedback on method parameters



Integration with third party software:

- Excel
- Origin
- Matlab
- ZView

System requirements

Minimum PC requirements are:

- Windows 7, 8, or 10 (32-bit or 64-bit)
- 1 GHz or faster 32-bit (x86) or 64-bit (x64) processor
- 1 GB RAM (32-bit) or 2 GB RAM (64-bit)

For more information about software visit www.palmsens.com/software

Also available as extension

The MUX8-R2 multiplexer is also available as generic multiplexer for PalmSens3, PalmSens4 and EmStat Blue.

For more information:
www.palmsens.com/product/mux8-r2/

Please don't hesitate to contact PalmSens for more details:
info@palmsens.com

PalmSens BV
The Netherlands
www.palmsens.com