PalmSens
Compact Electrochemical Interfaces

EmStat MUX8-R2™

Potentiostat with integrated multiplexer

v. 6-2018

Contents

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 5.

The integrated 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.

In configurations 3 and 4, the unselected channels can be switched to Ground which means they will have the working electrode's potential when they are not connected (since the active WE is always at virtual Ground potential).
Another option for configuration 3 and 4 is to have the unselected channels at a different potential which can be an offset of -1.5 to 1.5 V from the applied potential on the active WE.

Software

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

software for Windows and Android

PSTrace for Windows supports all techniques and device functionalities and includes advanced data analysis functions, export functions, scripting and more.
PSTouch for Android supports all techniques supported by EmStat.

Minimum PC requirements for PSTrace:
- 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

The EmStatMUX8-R2 has the following connections:

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 page 8 for specifications about the cell connections

Supported Techniques

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:	Sequential	Alternating
▪ Linear Sweep Voltammetry	✓	
▪ Differential Pulse Voltammetry	✓	
▪ Square Wave Voltammetry	✓	
▪ Normal Pulse Voltammetry	✓	
▪ Cyclic Voltammetry	✓	
Techniques as a function of time:		
▪ Chronoamperometry	✓	✓
▪ Pulsed Amperometric Detection	✓	
▪ Multiple Pulse Amperometric Detection	✓	
▪ Open Circuit Potentiometry	✓	✓
▪ Multistep Amperometry	✓	
▪ Mixed Mode *(partly supported)*	✓	

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.

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)
CA / 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
▪ compliance voltage	±10 V

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 8 for specifications about the cell connections

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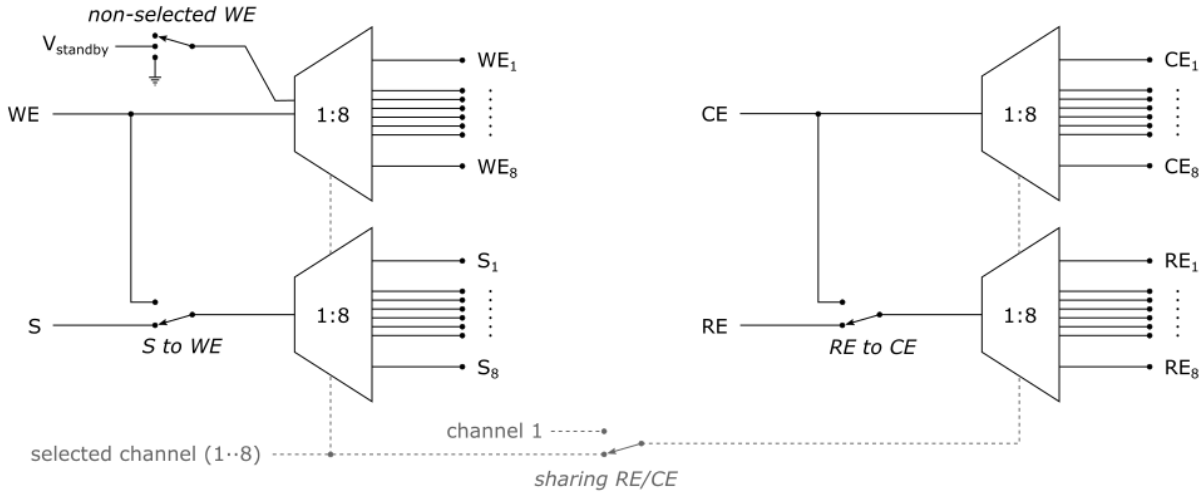
MUX8-R2 Functional Diagram



Stacking

Each multiplexer has a Link connector which can be used to daisy chain to another 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.

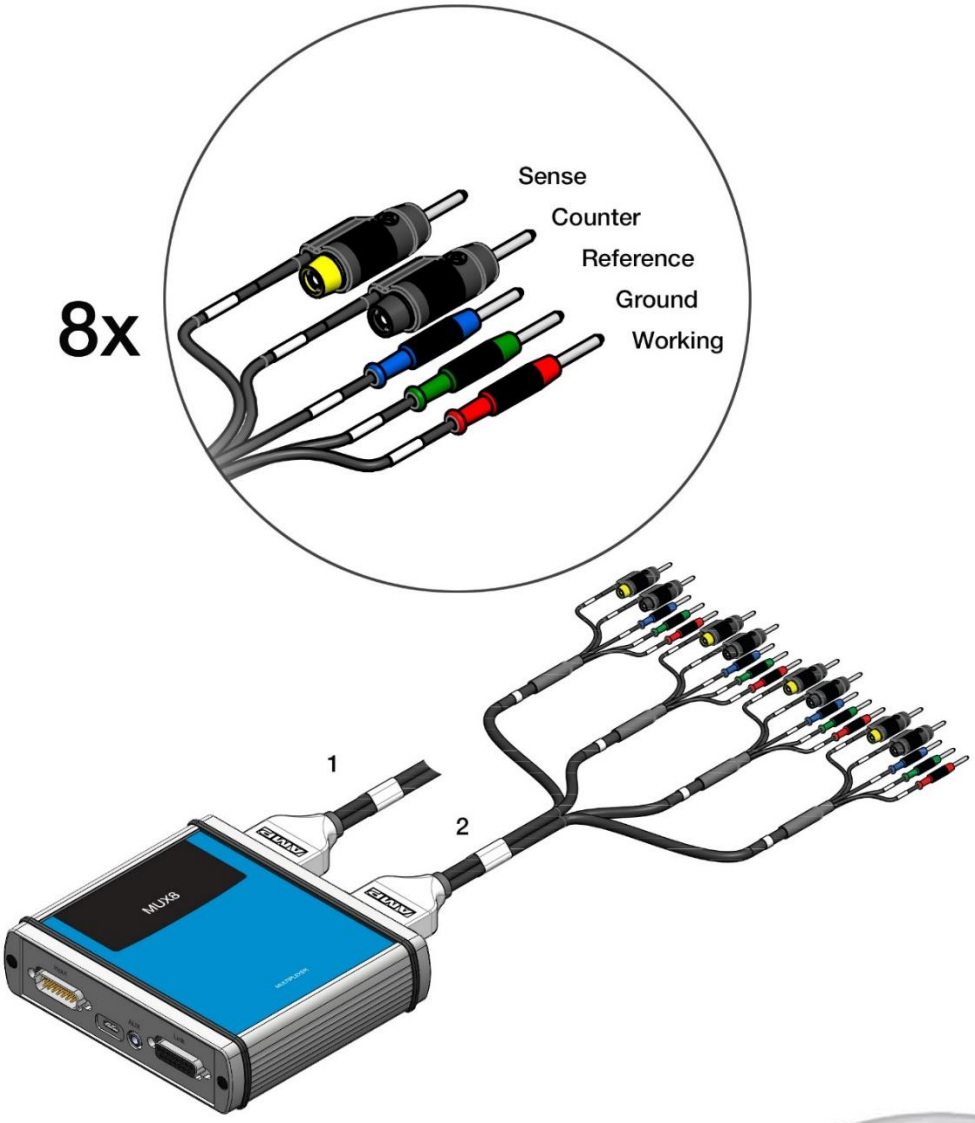
Magnetic feet and top for easy stacking

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



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:

Another option is to connect one or two screw-terminals directly in the multiplexer.

Order code: MUX08R2-ST

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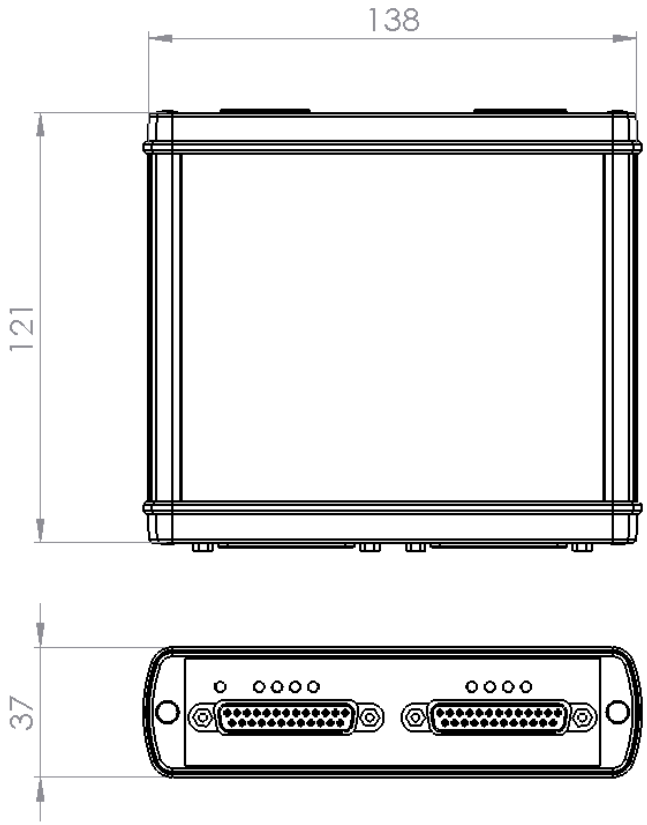
EmStatMUX8-R2 Dimensions

Dimensions in mm:



Please do not hesitate to contact PalmSens for more details:
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