Multi PalmSens *4* ™

multi-channel
Potentiostat / Galvanostat / Impedance Analyzer

PalmSens
Compact Electrochemical Interfaces

Contents

MultiPalmSens4
Potentiostat / Galvanostat / Impedance Analyzer

The MultiPalmSens4 is a flexible multi-channel potentiostat, galvanostat and impedance analyzer which you can fully tailor to your requirements and budget.

Always a backup

Every channel of the MultiPalmSens4 is equipped with an internal storage of 8 GB. This means all your measurements[1] can automatically be saved on-board as backup. Measurements can be browsed and transferred to the PC easily using the MultiTrace software for Windows.

[1] *Not supported: EIS, MultiStep and MixedMode*

Available channel configurations

Each channel can be configured with the following options:

Potential range	Channel configuration:	
	MPS4.F#.05	-5 V to +5 V
	MPS4.F#.10	-10 V to +10 V
EIS configuration	Channel configuration:	
	MPS4.F0.##	NO EIS
	MPS4.F1.##	100 kHz
	MPS4.F2.##	1 MHz
Optional	BiPot module	
Optional	IR Drop Compensation module	

For example, a single channel can have configuration
MPS4.F1.05 which means it will have max. 100 kHZ for EIS with ±5V potential range, or
MPS4.F2.10+BiPot for max. 1 MHz EIS with ±10V and a BiPot module.

The MultiPalmSens4 can also be configured with **galvanically isolated** (floating) channels.

Configure your MultiPalmSens4 on:
www.palmsens.com/mps4

Supported Techniques

Voltammetric techniques
- Linear Sweep Voltammetry   LSV
- Differential Pulse Voltammetry   DPV
- Square Wave Voltammetry   SWV
- Normal Pulse Voltammetry   NPV
- AC Voltammetry   ACV
- (Fast) Cyclic Voltammetry   CV

Note: the above techniques can also be used for stripping voltammetry

Techniques as a function of time
- ChronoAmperometry   CA
- Pulsed Amperometric Detection   PAD
- Multiple Pulse Amperometric Detection   MPAD
- Fast Amperometry   FAMP
- ChronoPotentiometry   CP
- Open Circuit Potentiometry   OCP
- Multistep Amperometry   MA
- Multistep Potentiometry   MP
- Mixed Mode   MM

Electrochemical Impedance Spectroscopy (EIS)
Impedance spectroscopy / EIS
- Frequency scan
- Potential scan
- Fixed potential
- Time scan

Next to the classic spectrum (frequency scan with fixed DC potential) a DC potential scan can be done at fixed frequency or a frequency scan at each potential of the potential scan.

MultiTrace: Software for Windows

MultiTrace can run in two different modes:
- **Individual Mode**, where each channel can run a measurement or script independently from the other channels
- **Simultaneous Mode**, where all channels run the same measurement.

Individual Mode

The individual mode shows an overview of all channels. Each channel can be selected separately and can run a measurement independently in parallel with the other channels.
You can also run a separate script on each channel or control peripherals like a multiplexer.
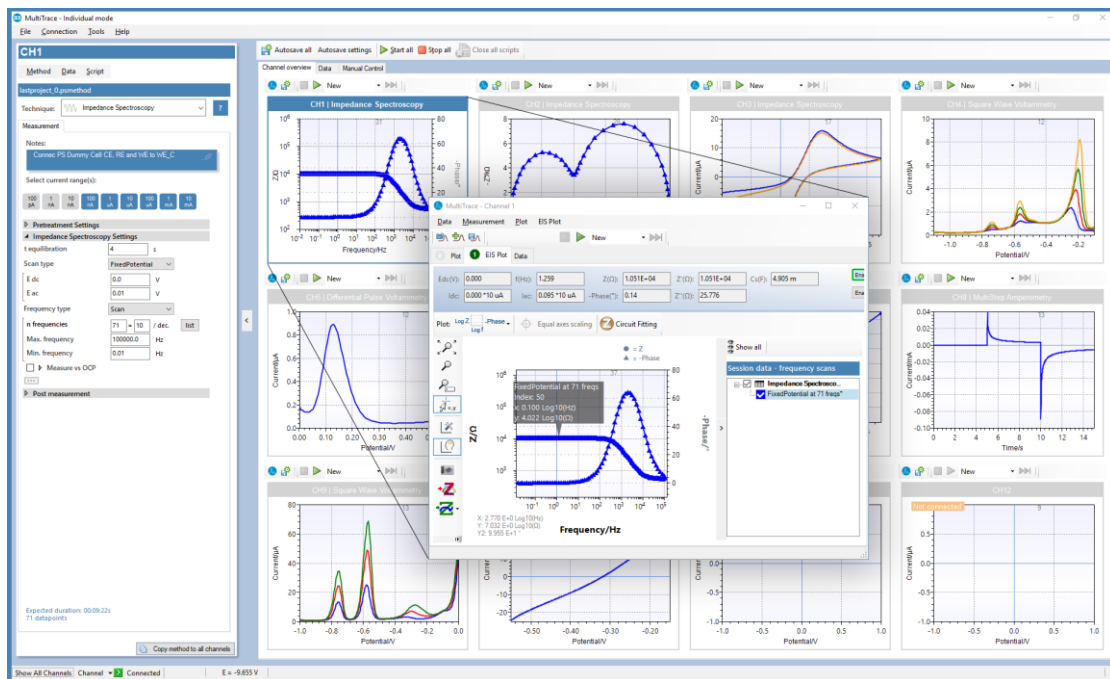
MultiTrace in Individual Mode with a plot window open for channel 1.

Other functions in MultiTrace 4

- Equivalent Circuit Fitting
- Scripting (on each channel)
- 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 MultiPalmSens4's internal storage
- Dynamic feedback on method parameters
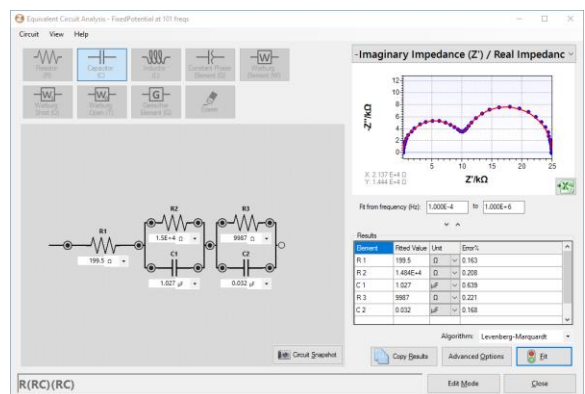
Simultaneous Mode

MultiTrace in Simultaneous Mode

In the Simultaneous Mode the MultiPalmSens4 works with all channels running the same measurement in parallel at the same time. There is only one active method in the Method Editor which is started on all channels simultaneously upon start.
All results are presented as overlays in the same plot.

Combining instruments

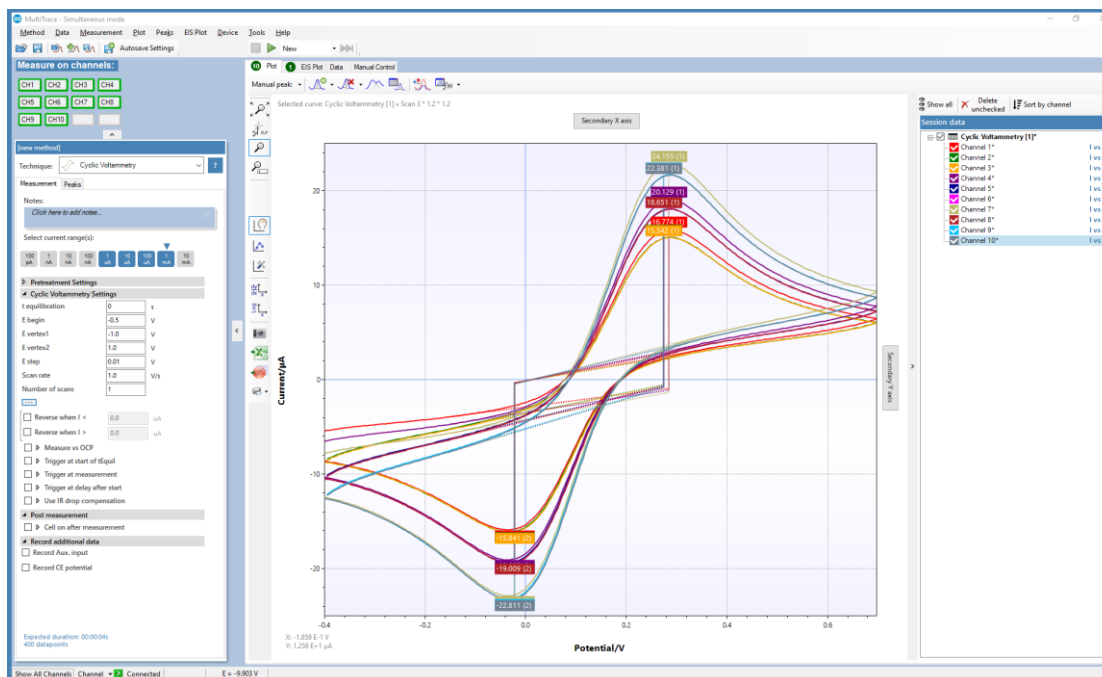MultiTrace also allows you to combine different multi-channel or single-channel potentiostats. Each single instrument can be assigned with a channel number and description. This allows you to extend your existing MultiPalmSens4 with a single-channel EmStat or PalmSens and let them work together as if they are one multi-channel device.

Integration with third party software:
- Excel
- Origin
- Matlab
- ZView
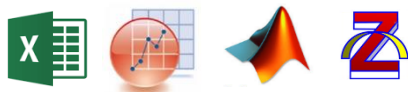
System requirements

Minimum PC requirements are:
- Windows Vista, 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

Measurement Specifications

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

General voltammetric parameters:

Channel configuration (see page 2):	MPS4.F0.05 MPS4.F1.05 MPS4.F2.05	MPS4.F0.10 MPS4.F1.10 MPS4.F2.10
Potential range:	-5 V to +5 V	-10 V to +10 V
Step potential:	0.075 mV to 250 mV	0.075 mV to 250 mV
Pulse potential:	0.075 mV to 250 mV	0.075 mV to 250 mV

Limits of some technique specific parameters for PalmSens4:

Technique	Parameter	Value
Normal Pulse and Differential Pulse Voltammetry:	Scan rate:	0.1 mV/s (75 µV step) to 100 mV/s (5 mV step)
	Pulse time:	10 ms to 300 ms
Square Wave Voltammetry[1] and AC Voltammetry:	Frequency:	1 Hz to 2000 Hz [1]
Linear Sweep and Cyclic Voltammetry:	Scan rate:	0.01 mV/s (75 µV step) to 500 V/s (10 mV step)
Pulsed Amperometric Detection:	Interval time:	50 ms to 300 s
	Pulse time:	1 ms to 1 s
	Maximum run time:	640000 s (> 7 days at 10 s interval)
Multiple Pulse Amperometric Detection:	Pulse times:	100 ms to 2 s
	Run time:	10 s to 100000 s
	Number of potential levels:	3
ChronoAmperometry, ChronoPotentiometry and Open Circuit Potentiometry:	Interval time:	0.25 ms to 300 s
	Maximum run time:	1000000 s (> 10 days at 300 s interval)
Multistep Amperometry Multistep Potentiometry and Mixed Mode:	Interval time:	0.25 ms to 300 s
	Level switching overhead time:	±80 ms
	Number of levels:	1 to 255
	Number of cycles:	1 to 20000
	Maximum run time:	> 1 year
Fast Amperometry:	Interval time:	0.02 ms to 1 s
	Maximum run time:	30 s
	Maximum number of points:	65000 (4000 for interval time < 0.2 ms)

Note: some limits of parameters are set for practical reasons and can be modified on request.

[1] *MultiTrace provides the option to measure forward and reverse currents separately.*

System Channel Specifications

General

		Channel config	MPS4.F#.05	MPS4.F#.10
▪ dc-potential range			±5 V	±10 V
▪ compliance voltage	±10 V			
▪ maximum current	±30 mA (typical)			
▪ max. acquisition rate	150000 points/s			

Potentiostat (controlled potential mode)

- ▪ applied dc-potential resolution 75 µV
- ▪ applied potential accuracy ≤ 0.1% ±1 mV offset
- ▪ current ranges 100 pA to 10 mA (9 ranges)
- ▪ current accuracy ≤ 0.1% at FSR[1]
- ▪ measured current resolution 0.006% of current range (5 fA on 100 pA range)

Galvanostat (controlled current mode)

- ▪ current ranges 1 nA to 10 mA (8 ranges)
- ▪ applied dc-current range ±6 times applied current range
- ▪ applied dc-current resolution 0.005% of applied current range
- ▪ measured dc-potential resolution 75 µV at ±10 V
  7.5 µV at ±1 V
  0.75 µV at ±0.1 V

FRA / EIS (impedance measurements)

		Channel config	MPS4.F1.##	MPS4.F2.##
▪ frequency range			10 µHz to 100 kHz	10 µHz to 1 MHz
▪ ac-amplitude range	1 mV to 0.25 V rms, or 0.6 V p-p			

Electrometer

- ▪ electrometer amplifier input > 1 TΩ // 10 pF
- ▪ bandwidth 1 MHz

Other

- ▪ housing 15 x 25 x 25 cm^3
- ▪ weight +/- 4 kg
- ▪ temperature range 0 °C to + 50 °C
- ▪ power supply external 12 V AC/DC adapter
- ▪ communication USB
- ▪ internal storage space 8 GB per channel
  or +/- 800000 measurements incl. method info
 (assuming 200 data points per measurement)

Auxiliary port (D-Sub 15)

- ▪ analog input ±10 V, 18 bit
- ▪ analog output 0-10 V, 12 bit (1 kOhm output impedance)
- ▪ 4 digital outputs 5 V
- ▪ 1 digital input 5 V
- ▪ I-out and E-out raw output of current and potential
  E-out ±10 V (1 kOhm output impedance)
  I-out ±6 V (1 kOhm output impedance)
- ▪ power 5 V output (max. 150 mA)

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[1] FSR = at full scale range

EIS Contour Accuracy Plot
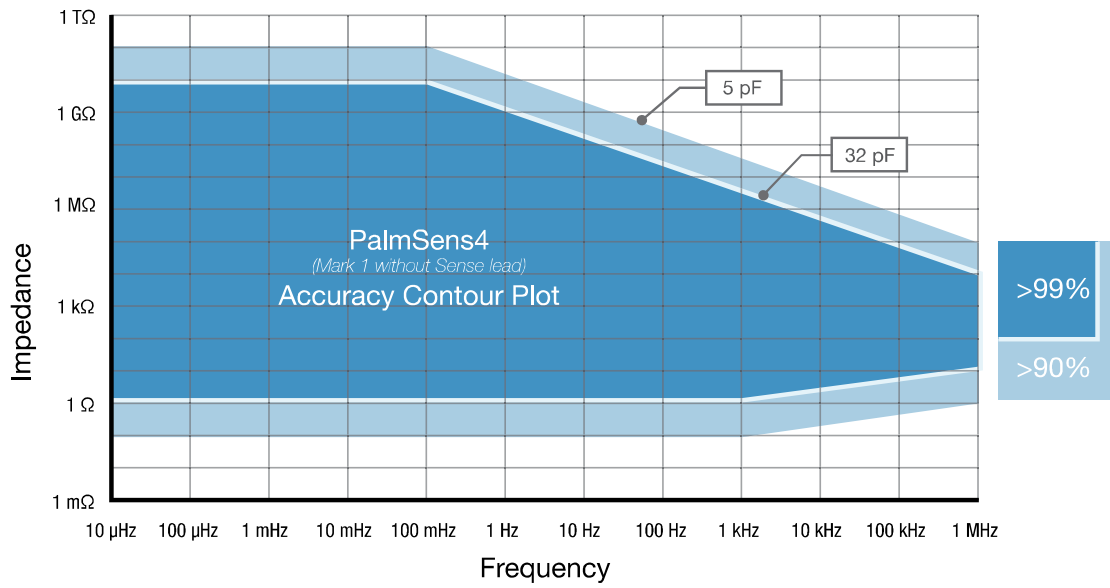
Note
The accuracy contour plot was determined under lab conditions and should be used for reference purposes. Please note that the true limits of an impedance measurement are influenced by all components in the system, e.g. cables, the environment, and the cell.

MultiPalmSens4 Accessories

The following accessories can be attached to any of the available channels of the MultiPalmSens instrument:

MUX8-R2 or MUX16 multiplexer

The MUX8-R2 is an 8 channel multiplexer. It allows the (Multi)PalmSens4 to measure up to 8 three-electrode cells or 8 sensors (2 or 3 electrode). In 8-WE mode it can measure up to eight working electrodes on sensor arrays with shared reference and counter electrodes.

The MUX16 is a 16 channel multiplexer. It allows the (Multi)PalmSens4 to measure up to 16 working electrodes with shared counter and reference electrodes.

Magnetic stirrer

The magnetic stirrer controlled by (Multi)PalmSens 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 PalmSens Differential Electrometer Amplifier (DEA) is a high impedance input amplifier. It can be used as a floating voltage amplifier with differential input and single output to the auxiliary port of PalmSens.

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

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

PalmSens BV
The Netherlands
www.palmsens.com

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