PalmSens

Compact Electrochemical Interfaces

Potentiostats / Galvanostats / Impedance Analyzers / Screen Printed Electrodes / Embedded / OEM solutions

PalmSens4™

Potentiostat / Galvanostat / Impedance Analyzer

- **±10 V** potential range with a resolution of 75 µV
- FRA/EIS from 10 µHz up to **1 MHz**
- **8 GB** internal storage memory
- Auxiliary port for controlling a stirrer, multiplexer or other peripheral

battery for 10+ hours operation
or powered by USB

155 mm x 85 mm x 35 mm

500 g

USB-C

with integrated Bluetooth®

Available configurations:

	Potential range ±5 V [05]	Potential range ±10 V [10]
NO EIS [F0]	PS4.F0.05	PS4.F0.10
EIS up to 100 kHz [F1]	PS4.F1.05	PS4.F1.10
EIS up to 1 MHz [F2]	PS4.F2.05	PS4.F2.10

Options:

- BiPot Module
- IR Drop Compensation Module

Specifications

Supported techniques

Voltammetric techniques

- Linear Sweep Voltammetry — LSV
- Differential Pulse Voltammetry — DPV
- Square Wave Voltammetry — SWV
- Normal Pulse Voltammetry — NPV
- AC Voltammetry — ACV
- Cyclic Voltammetry — CV

The above techniques can also be used for stripping voltammetry

- Stripping Chronopotentiometry — SCP / PSA

Techniques as a function of time

- ChronoAmperometry — CA
- ChronoCoulometry — CC
- Pulsed Amperometric Detection — PAD
- Multiple Pulse Amperometric Detection — MPAD
- Fast Amperometry — FAM
- ChronoPotentiometry — CP
- Open Circuit Potentiometry — OCP
- Multistep Amperometry — MA
- Multistep Potentiometry — MP
- Mixed Mode — MM

Impedance spectroscopy — EIS

- Potential scan
- Time scan
- Fixed potential

Scans can be performed at a fixed frequency or with a frequency scan.

See page 13 for an EIS accuracy contour plot.

Control PalmSens4 with
PSTrace for Windows

or with
PStouch for Android

or write your own code for PalmSens in
Visual Studio, Matlab or LabVIEW

see page 10 and 12 for more information

General

- dc-potential range — ±10 V (or ±5 V)
- compliance voltage — ±10 V
- maximum current — ±30 mA (typical)
- max. acquisition rate — 150000 points/s

Potentiostat (controlled potential mode)

- dc-potential resolution — 75 µV
- applied pot. accuracy — ≤ 0.1% ±1 mV offset
- current ranges — 100 pA to 10 mA (9 ranges)
- current accuracy — ≤ 0.1% at Full Scale Range
- current resolution — 0.006% of current range (5 fA on 100 pA range)

Galvanostat (controlled current mode)

- current ranges — 100 pA to 10 mA (9 ranges)
- dc-current range — ±6 times applied current range
- dc-current resolution — 0.005% of applied current range
- 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)

- frequency range — 10 µHz to 1 MHz (or 100 kHz)
- ac-amplitude range — 0.1 mV to 0.25 V (rms)

Electrometer

- input impedance — > 1 TOhm // 10 pF
- bandwidth — 1 MHz

Auxiliary port (D-Sub 15)

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

For more specifications visit **www.palmsens.com**
or e-mail us at **info@palmsens.com**.

PalmSens

EmStat™

Miniature Potentiostats

- Smallest research grade potentiostats available
- Ideal for embedded applications (OEM)
- Auxiliary port for controlling a stirrer, multiplexer or other peripheral (*Blue* only)

EmStat³ and 3+ blue

with integrated Bluetooth®

- battery for 10+ hours operation or USB
- 100 mm x 60 mm x 34 mm
- 250 g
- mini-USB

EmStat³ and 3+

- USB powered
- 62 mm x 46 mm x 28 mm
- 80 g
- mini-USB

Specifications

Supported techniques

Voltammetric techniques

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

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Techniques as a function of time

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▪ Pulsed Amperometric Detection	PAD
▪ Multiple Pulse Amperometric Detection	MPAD
▪ Open Circuit Potentiometry	OCP
▪ Multistep Amperometry	MA
▪ Mixed Mode (partly)	MM

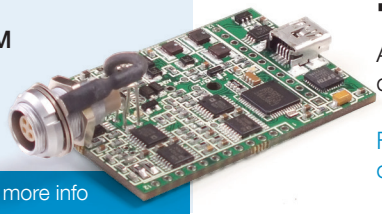
Control PalmSens4 with
PSTrace for Windows

or with
PStouch for Android

or write your own code for EmStat in
Visual Studio, Matlab or LabVIEW

see page 10 and 12 for more information

The EmStat potentiostat is available as module for OEM purposes:



see www.palmsens.com/oem for more info

Controlled potential mode (potentiostat)

EmStat (Blue) version	3	3+
▪ dc-potential range	± 3.000 V	± 4.000 V
▪ compliance voltage	± 5 V	± 8 V
▪ applied potential resolution	0.1 mV	0.125 mV
▪ applied potential accuracy	≤ 0.2%	≤ 0.3%
▪ current ranges	1 nA to 10 mA	1 nA to 100 mA
▪ maximum current (typical)	± 20 mA	± 100 mA

▪ current resolution	0.1% of current range, 1 pA at 1 nA range
▪ 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

Electrometer

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

EmStat Blue: Auxiliary port (D-Sub 15)

▪ analog input	0-4.096 V, 12 bit
▪ analog output	0-4.096 V, 12 bit
▪ 4 digital outputs and 1 digital input	5 V
▪ serial comms	Rx / Tx (TTL)
▪ power	5 V output (max. 50 mA)

EmStat Blue: Additional specifications

- integrated connector for screen printed electrodes
- battery for 6+ hours of measurement time
- integrated Bluetooth

An overview of extensions for EmStat Blue can be found on page 13.

For more specifications visit **www.palmsens.com**
or e-mail us at **info@palmsens.com**.

PalmSens

MultiPalmSens4™

Multi-channel Potentiostat / Galvanostat / Impedance Analyzer

- Available from 4 up to 10 channels
- Combined or individual channel control
- **±10 V** potential range with a resolution of 75 µV
- FRA/EIS from 10 µHz up to **1 MHz**
- **8 GB** internal storage memory per channel

External power supply

250 mm x 250 mm x 150 mm

+/- 3 kg

USB

Use our online MPS4 Configurator with instant prices* to assemble the instrument that fits your requirements and budget:

www.palmsens.com/mps4config

* online prices not available in Asia and South America

Options per channel:

- ±5 V or ±10 V potential range
- Max. 100 kHz or 1 MHz FRA/EIS
- Galvanic Isolation (floating)
- BiPot Module
- IR Drop Compensation Module

Specifications

Supported techniques on each channel

Voltammetric techniques

- Linear Sweep Voltammetry — LSV
- Differential Pulse Voltammetry — DPV
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- Potential scan
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  Scans can be performed at a fixed frequency or with a frequency scan.

See page 13 for an EIS accuracy contour plot.

All multi-channel instruments come with:

MultiTrace

for Windows.

see page 11 for more information

Specifications of each channel

- dc-potential range — ±10 V (or ±5 V)
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- current ranges — 1 nA to 10 mA (8 ranges)
- dc-current range — ±6 times applied current range
- dc-current resolution — 0.005% of applied current range
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- ac-amplitude range — 0.1 mV to 0.25 V (rms)

Electrometer

- input impedance — > 1 TOhm // 10 pF
- bandwidth — 1 MHz

Auxiliary port (D-Sub 15 on each channel)

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

For more specifications visit **www.palmsens.com**
or e-mail us at **info@palmsens.com**.

PalmSens

*Multi*EmStat™

Multi-channel Potentiostats

- Galvanically isolated channels (optional)
- Combined or individual channel control
- Compact design

*Multi*EmStat³

4 channels

- External power supply
- 115 mm x 85 mm x 35 mm
- 260 g
- USB

*Multi*EmStat³ and 3+

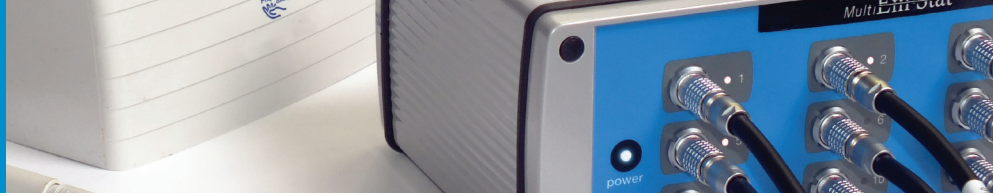
4, 8 or 12 channels

- External power supply
- 120 mm x 210 mm x 75 mm
- +/- 2 kg
- USB

Options:

- Galvanic Isolation (floating)
- External I/O (auxiliary)

Specifications



Supported techniques

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Techniques as a function of time

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▪ Open Circuit Potentiometry	OCP
▪ Multistep Amperometry	MA
▪ Mixed Mode (partly)	MM

All multi-channel instruments come with:

MultiTrace

for Windows.

see page 11 for more information

Controlled potential mode (potentiostat)

MultiEmStat^n and EmStat^3 4WE	3	3+
▪ dc-potential range	± 3.000 V	± 4.000 V
▪ compliance voltage	± 5 V	± 8 V
▪ applied potential resolution	0.1 mV	0.125 mV
▪ applied potential accuracy	≤ 0.2%	≤ 0.3%
▪ current ranges	1 nA to 10 mA	1 nA to 100 mA
▪ maximum current (typical)	± 20 mA	± 100 mA

▪ current resolution	0.1% of current range, 1 pA at 1 nA range
▪ 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

General

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

For more specifications visit www.palmsens.com or e-mail us: info@palmsens.com.

EmStat^3 4WE™

EmStat3 4WE is a polypotentiostat which is used with sensors or cells with up to 4 working electrodes, all sharing the same reference and counter electrodes. The instrument has one complete EmStat3 potentiostat and 3 individual potentiostat modules for the three additional working electrodes.

Other configurations are available on request.

PalmSens

PC Software

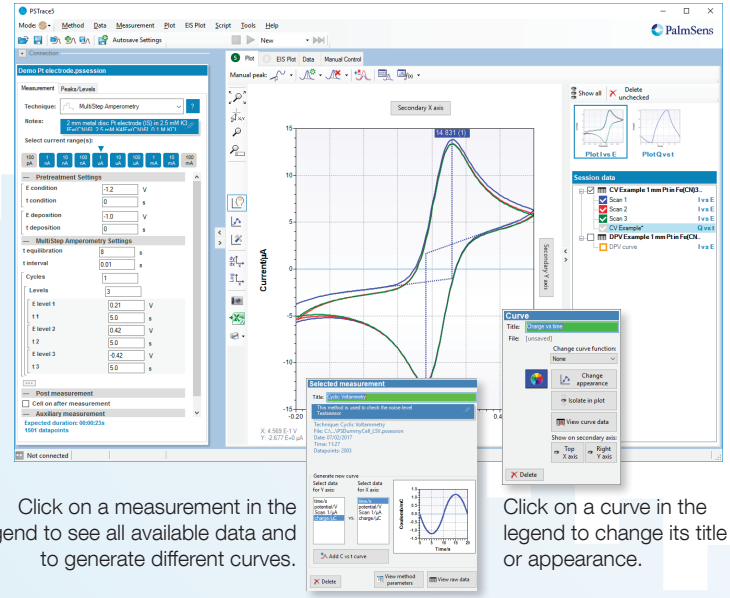
Compatible with Windows 7, 8 and 10

PSTrace 5

PalmSens and EmStat instruments come with the PSTrace software for Windows. PSTrace provides support for all techniques and instrument functionalities. The interface of PSTrace is designed to easily handle multiple curves in a single window.

PSTrace features:

- Automated and manual peak search
- Curve addition and subtraction (e.g. with a measured blank)
- Equivalent Circuit Fitting for Impedance Spectroscopy
- Export data to Excel and Origin with one mouse click
- Trace Analysis
- Corrosion Analysis
- Run a script for running a sequence of methods and commands (see below).

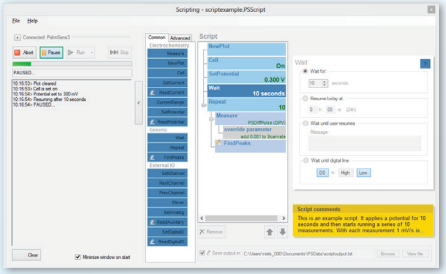


Click on a measurement in the legend to see all available data and to generate different curves.

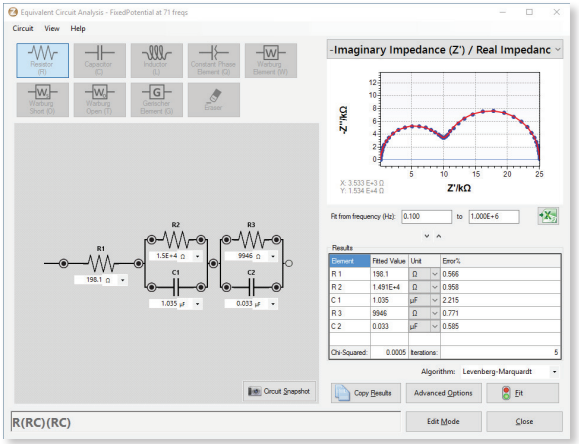
Click on a curve in the legend to change its title or appearance.

Script window for automated tasks, including:

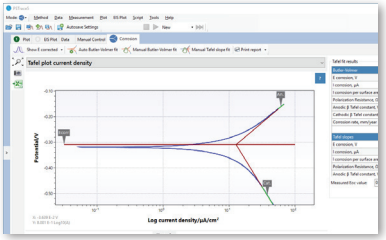
- Cell control
- Running measurements
- Starting on external or time trigger
- Controlling external devices



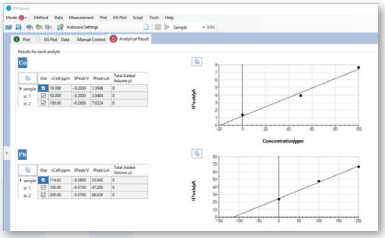
Equivalent Circuit Fitting:



Corrosion Mode, including Tafel Plot Analysis:



Analytical Mode, for Trace Analysis:



PalmSens Software Development Kits

Visual Studio MATLAB LabVIEW

Software Development Kits

A Software Development Kit with libraries and code examples is available. The libraries provide easy implementation, even for novice programmers.

MultiTrace

MultiTrace software for Windows is included with all multi-channel instruments.

MultiTrace software controls all individual potentiostats.
It is a dedicated program based on the PSTrace software for Windows (for PalmSens and EmStat instruments).

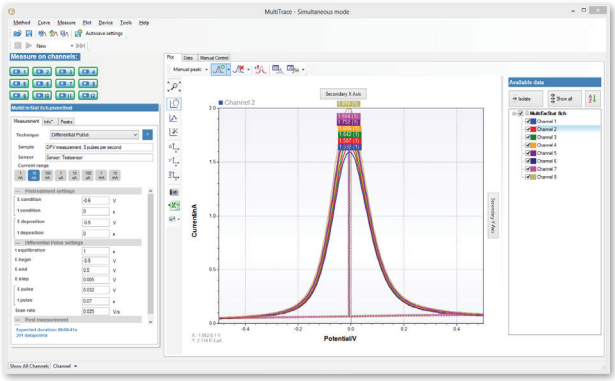
MultiTrace features two modes:

- **Simultaneous Mode: use channels simultaneously**
  All potentiostats run the same measurement.
  The measured curves are displayed in a single plot and stored in a single data file.

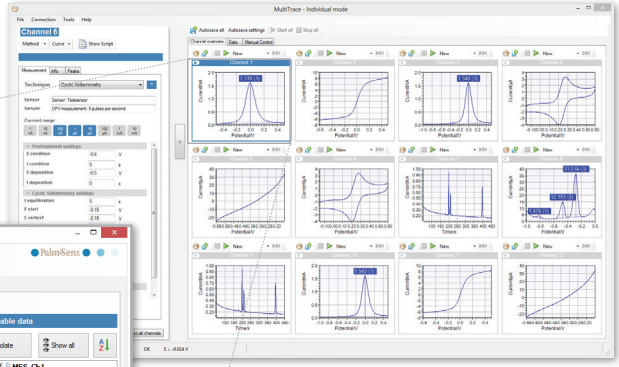
- **Individual Mode: use channels individually**
  All potentiostats are used independently. Each measurement can be different and can be started individually. It is also possible to start all measurements simultaneously. Each measured curve is shown in its own plot. Data files are stored separately.

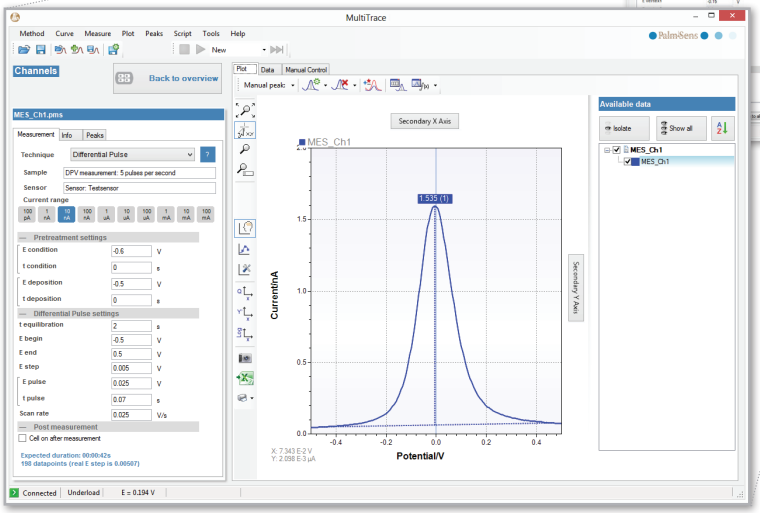
In Individual Mode, MultiTrace provides the option to open a separate PSTrace window for each channel.
Scripts can be run for each channel separately.

MultiTrace in Simultaneous Mode:



MultiTrace in Individual Mode:





Double-click a channel to open a fully featured window

PalmSens

Android app

PStouch

PStouch is an app for Android devices that can be used with all PalmSens and EmStat potentiostats.
PStouch can communicate with your potentiostat via USB* or wirelessly with the EmStat Blue or PalmSens via Bluetooth. Bluetooth extensions are available for all PalmSens models. PalmSens4 has integrated Bluetooth.

PStouch features:

- Setting up and running measurements
- Loading and saving measured curves
- Analysing and manipulating peaks
- Sharing data directly via e-mail or Dropbox
- Support for PalmSens accessories such as a multiplexer, stirrer or bipot

All method and curve files are fully compatible with PSTrace software for Windows.

PStouch is designed for use with tablets and smartphones.
Download it for free in the Google Play Store.

Google play

Perform measurements in the field
and share data instantly with colleagues in the lab

* *This requires your tablet or phone to support USB On-The-Go. Most Android devices do.*

Accessories

Available accessories for PalmSens and EmStat:

- **MUX8-R2 Multiplexer:** a multiplexer for use with 2- or 3-electrode sensors or cells, up to 8 channels.
- **MUX16 Multiplexer:** 16 channels with 16 working electrodes. Shared counter and reference electrode, or each working electrode with each its own combined reference/counter electrode.
- **Magnetic Stirrer** controlled by PalmSens or EmStat for stripping analysis applications.
- **LM35** temperature sensor.

MUX8-R2 multiplexer: also available with integrated EmStat potentiostat.

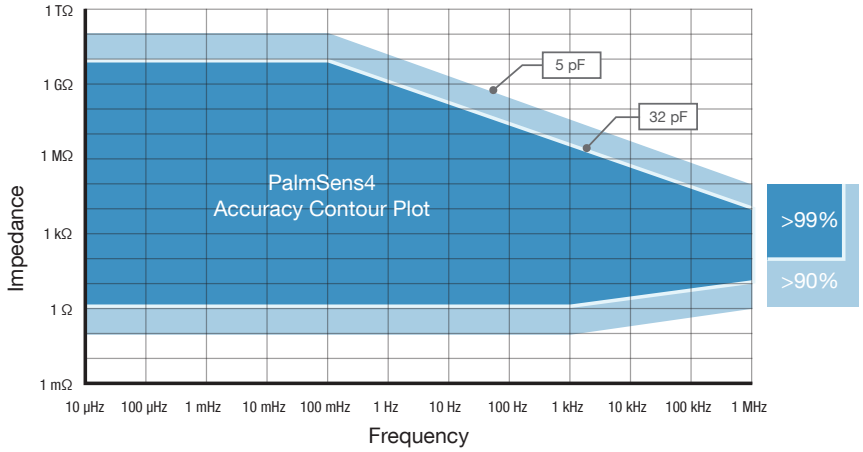
Available accessories for PalmSens:

- **Bluetooth Extension** for wireless connection for PalmSens3. (Bluetooth is integrated in PalmSens4)
- **BiPot Module** for use with two working electrodes.
- **Differential Electrometer Amplifier** general purpose input amplifier. Can be used as a floating voltage amplifier with differential input and single output to the auxiliary port. Default range is -10V to 10V (1x gain). Possible gains are: 2x, 5x, 10x, 20x, 50x, 100x, etc

Differential Electrometer Amplifier

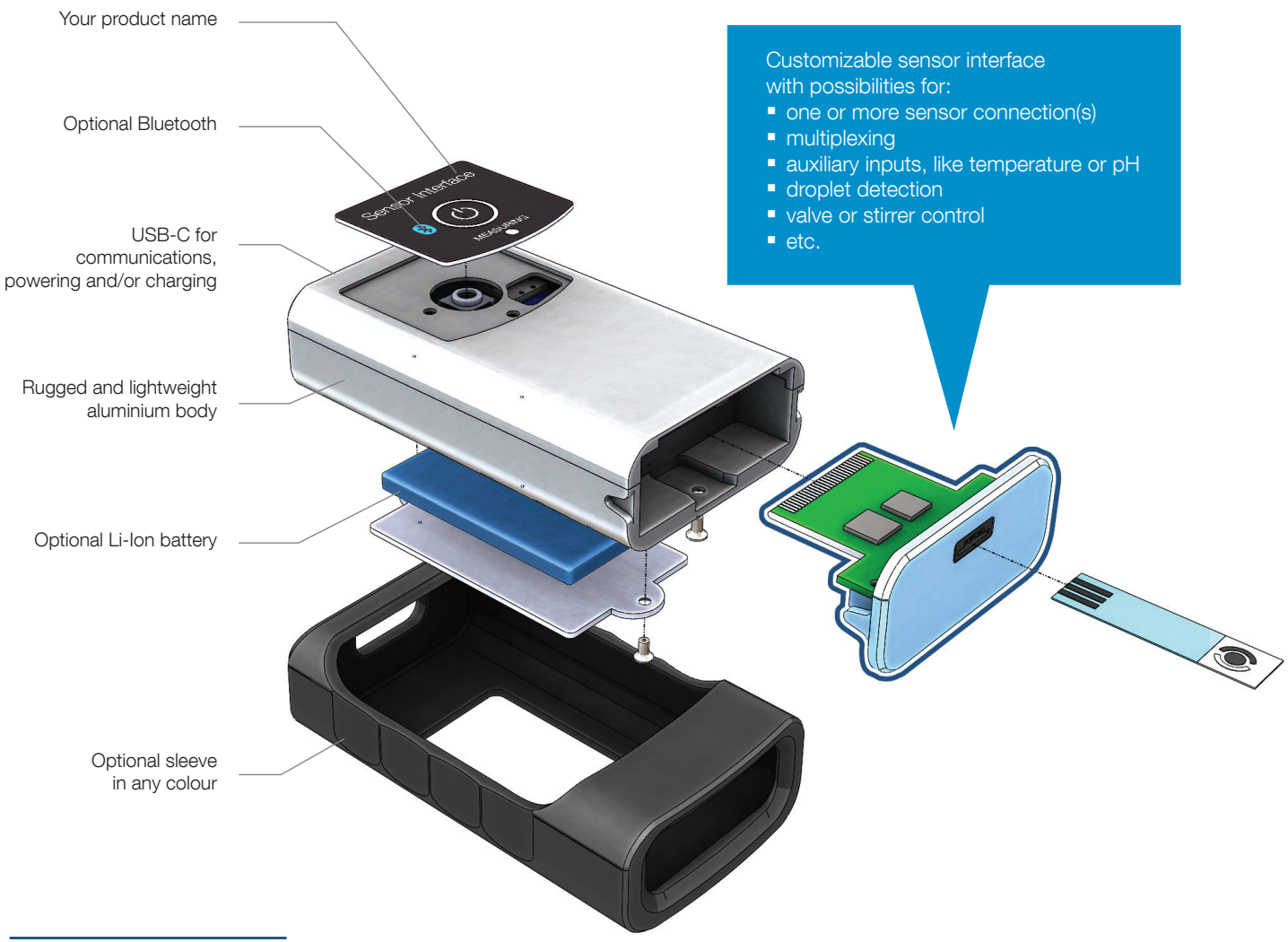
PalmSens4 performance

This typical contour accuracy plot for PalmSens4 was created with original PalmSens cables and clips using high-precision resistors and capacitors.



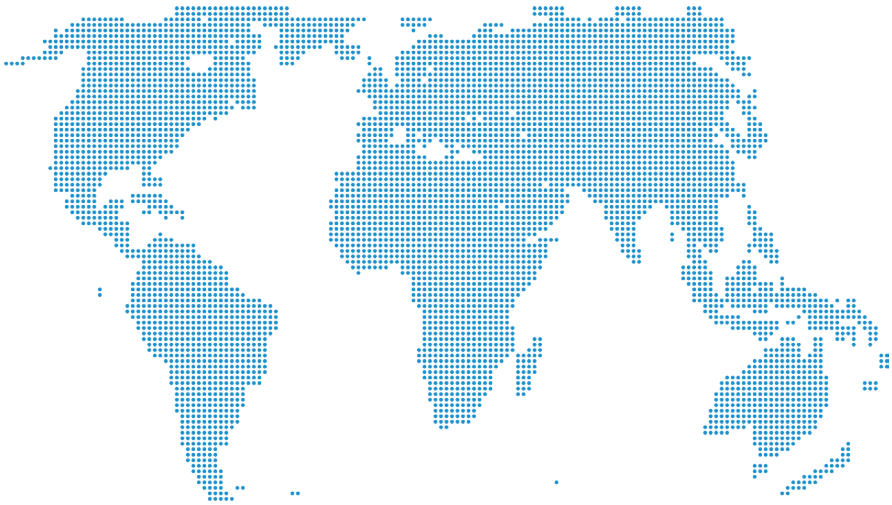
EmStat GO™

A potentiostat tailored to your application



More information: www.palmsens.com/esgo

Worldwide distribution



All PalmSens BV instruments
come standard with a

3 YEAR WARRANTY

PalmSens
Compact Electrochemical Interfaces

PalmSens BV is a family business founded in 2001 by Dr. Kees van Velzen, who was one of the driving forces in the field of potentiostat digitalization in the late 80's and 90's. PalmSens was the first company to reduce a research grade potentiostat to a size that fits in your pocket.

Our mission is to make electrochemical research more accessible and to accelerate the implementation of electrochemical applications for use in everyday work and life.

Feel free to contact us:

PalmSens BV
Randhoeve 221
3995 GA Houten
The Netherlands

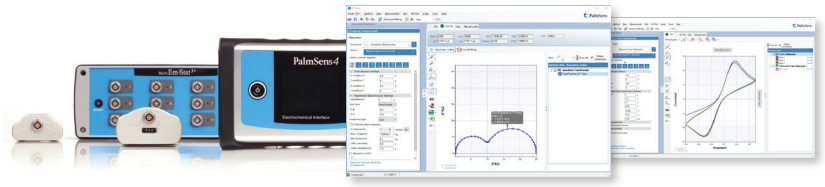
Tel.: +31 30 2459211
Fax.: +31 30 2459212

info@palmsens.com

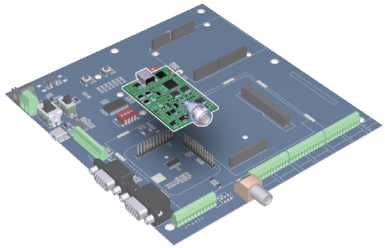
www.palmsens.com

www.palmsens.com

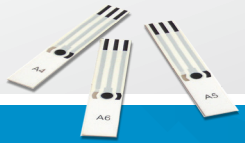
Instruments, accessories and software



OEM products for EmStat integration / custom design



Screen printed and classical electrodes



PalmSens BV
Randhoeve 221
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Compact Electrochemical Interfaces