

PalmSens

Compact Electrochemical Interfaces



Potentiostats / Galvanostats / Impedance Analyzers / Screen Printed Electrodes

PalmSens4™

Potentiostat / Galvanostat / Impedance Analyzer

- FRA/EIS from 10 μ Hz to 100 kHz / 1 MHz (optional)
- 9 current ranges: 100 pA to 10 mA
- Compact and rugged design
- USB and Bluetooth connection
- 18-bit resolution



- ⚡ battery for 10+ hours operation
- 📏 155 x 85 x 35 mm
- ⚖️ 500 g
- 🔌 USB type C
- 📶 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 for WE2
- iR Compensation Module

an overview of accessories can be found on page 17

Control PalmSens4 with
PSTrace for Windows
or with
PSTouch for Android



Build your own tools for PalmSens using the
Software Development Kit for .NET



see pages 10, 12 and 14 for more information

Specifications



Supported techniques

Voltammetric techniques

▪ Linear Sweep Voltammetry	LSV
▪ Cyclic Voltammetry	CV
▪ Fast Cyclic Voltammetry	FCV
▪ AC Voltammetry	ACV

Pulsed Techniques

▪ Differential Pulse Voltammetry	DPV
▪ Square Wave Voltammetry	SWV
▪ Normal Pulse Voltammetry	NPV
<i>These methods can all be used in their stripping modes which are applied for (ultra-) trace analysis</i>	

Amperometric techniques

▪ Chronoamperometry	CA
▪ Zero Resistance Amperometry	ZRA
▪ Chronocoulometry	CC
▪ Multistep Amperometry	MA
▪ Fast Amperometry	FAM
▪ Pulsed Amperometric Detection	PAD
▪ Multiple Pulse Amperometric Detection	MPAD

Galvanostatic techniques

▪ Linear Sweep Potentiometry	LSP
▪ Chronopotentiometry	CP
▪ Multistep Potentiometry	MP
▪ Open Circuit Potentiometry	OCP
▪ Stripping Chronopotentiometry	SCP / PSA

Impedance spectroscopy

▪ Potentiostatic	EIS
▪ Galvanostatic	GEIS

Other

▪ Mixed Mode	MM
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General specifications

▪ dc-potential range	± 10 V (or ± 5 V)
▪ compliance voltage	± 10 V
▪ maximum current	± 30 mA (typical)
▪ max. acquisition rate	150,000 points/s

Potentiostat (controlled potential mode)

▪ dc-potential resolution	76.3 μ V
▪ applied pot. accuracy	$\leq 0.1\% \pm 1$ mV offset
▪ current ranges	100 pA to 10 mA (9 ranges)
▪ current accuracy	$\leq 0.1\%$ at Full Scale Range
▪ current resolution	0.005% of current range (18-bit, 5 fA on 100 pA range) 0.0025% of 10 mA range

Galvanostat (controlled current mode)

▪ current ranges	1 nA to 10 mA (8 ranges)
▪ dc-current range	$\pm 6 \times$ applied current range
▪ dc-current resolution	0.0076% of applied range (<10mA) 0.0038% of 10 mA range
▪ dc-potential resolution	78 μ V at ± 10 V (gain 1, 18-bit) 7.8 μ V at ± 1 V (gain 10) 0.78 μ V at ± 0.1 V (gain 100)

FRA / EIS (impedance measurements)

▪ frequency range	10 μ Hz to 100 kHz / 1 MHz (optional)
▪ ac-amplitude range	0.1 mV to 0.25 V (rms), or 0.7 V p-p

GEIS (galvanostatic impedance measurement)

▪ frequency range	10 μ Hz to 100 kHz
▪ ac-amplitude range	0.001 \times CR to 0.4 \times CR (<10 mA) 0.001 \times CR to 0.2 \times CR (10 mA) (CR = current range)

Electrometer

▪ input impedance	> 1 T Ω // 10 pF
▪ bandwidth	1 MHz

Auxiliary port (DSUB15)

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

MultiPalmSens4™

Multi-channel Potentiostat / Galvanostat / Impedance Analyzer

- 4 to 10 channels available in different configurations
- Channel synchronization for polypotentiostat functionality
- 8 GB internal storage memory per channel
- Combined or individual channel control



Options per channel:

- ± 5 V or ± 10 V potential range
- Optional EIS: max 100 kHz or 1 MHz
- Galvanic Isolation (floating)
- BiPot Module
- iR Compensation Module

refer to the PalmSens4 specifications
on [page 3](#) for details

www.palmsens.com/mps4

Use our online Configurator to assemble the instrument
that fits your requirements and budget:

palmsens.com/mps4config

MultiEmStat4TM

Multi-channel Potentiostat / Galvanostat / Impedance Analyzer

- 4, 8 or 12 channels
- Channel synchronization for polypotentiostat functionality
- 500 MB internal storage memory per channel
- Combined or individual channel control



www.palmsens.com/mes4

Our best potentiostats
available as multi-channel
instruments

Control multi-channel instruments with:



see page 11 for more information

Two versions:

- Low Range and High Range
- ± 3 V or ± 6 V potential range
- ± 30 mA or ± 200 mA max. current

Optional:


- EIS: 10 μ Hz to 200 kHz
- Galvanic Isolation (floating)

refer to the Emstat4S specifications
on [page 7](#) for details

EmStat4S™

Potentiostat / Galvanostat / Impedance Analyzer

- Two versions: Low Range and High Range
- FRA / EIS from 10 μ Hz up to 200 kHz (optional)
- Desktop performance in the palm of your hand

 500 MB storage on-board, equivalent to >15M data points



LR

HR

dc-potential range ± 3 V

Max. current ± 30 mA

dc-potential range ± 6 V

Max. current ± 200 mA



MethodSCRIPT™

Works with MethodSCRIPT, see [page 13](#) for details.

Available configurations:

	Potential range	
	± 3 V [LR]	± 6 V [HR]
NO EIS [F0]	C-ES4S-LR.F0	C-ES4S-HR.F0
EIS up to 200 kHz [F1]	C-ES4S-LR.F1	C-ES4S-HR.F1



USB powered



72 x 55 x 26 mm



130 g

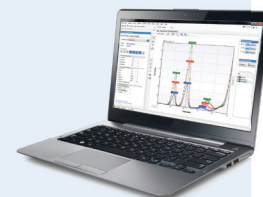


USB type C

Control EmStat4S with
PSTrace for Windows



or write your own code for EmStat4S in
Python, Visual Studio, Matlab or other environment or language



see pages 10, 12 and 14 for more information

Specifications



Supported techniques on each channel

Voltammetric techniques

- | | |
|----------------------------|-------|
| ▪ Linear Sweep Voltammetry | LSV |
| ▪ Cyclic Voltammetry | CV |
| ▪ Fast Cyclic Voltammetry | FCV * |
| ▪ AC Voltammetry | ACV * |

Pulsed techniques

- | | |
|----------------------------------|-----|
| ▪ Differential Pulse Voltammetry | DPV |
| ▪ Square Wave Voltammetry | SWV |
| ▪ Normal Pulse Voltammetry | NPV |
- These methods can all be used in their stripping modes which are applied for (ultra-) trace analysis*

Amperometric techniques

- | | |
|---|-------|
| ▪ ChronoAmperometry | CA |
| ▪ Zero Resistance Amperometry | ZRA |
| ▪ Chronocoulometry | CC |
| ▪ Multistep Amperometry | MA |
| ▪ Fast Amperometry | FAM * |
| ▪ Pulsed Amperometric Detection | PAD |
| ▪ Multiple Pulse Amperometric Detection | MPAD |

Galvanostatic techniques

- | | |
|---------------------------------|-----------|
| ▪ Linear Sweep Potentiometry | LSP |
| ▪ Chronopotentiometry | CP |
| ▪ Multistep Potentiometry | MP |
| ▪ Open Circuit Potentiometry | OCP |
| ▪ Stripping Chronopotentiometry | SCP / PSA |

Impedance spectroscopy

- | | |
|------------------|-------|
| ▪ Potentiostatic | EIS |
| ▪ Galvanostatic | GEIS* |

Other

- | | |
|--------------|----|
| ▪ Mixed Mode | MM |
|--------------|----|

* This technique will be enabled with PStace 5.10 or higher, expected later in 2022.

General

model LR

HR

- | | | |
|-------------------------|--------------|---------|
| ▪ dc-potential range | ±3 V | ±6 V |
| ▪ compliance voltage | ±5 V | ±8 V |
| ▪ maximum current | ±30 mA | ±200 mA |
| ▪ max. acquisition rate | 1M samples/s | |

Potentiostat (controlled potential mode)

- | | | |
|---------------------------|---------------------------------------|------------------------------|
| ▪ dc-potential resolution | 100 μ V | 183 μ V |
| ▪ current ranges | 1 nA to 10 mA
8 ranges | 100 nA to 100 mA
7 ranges |
| ▪ applied pot. accuracy | $\leq 0.2\% \pm 1$ mV offset | |
| ▪ current resolution | 0.009% of CR
(92 fA on 1 nA range) | |
| ▪ current accuracy | $\leq 0.2\%$ at Full Scale Range | |

Galvanostat (controlled current mode)

- | | | |
|---------------------------|---|--|
| ▪ current ranges | 10 nA, 1 μ A,
100 μ A, 10 mA
4 ranges | 1 μ A, 100 μ A,
10 mA, 100 mA
4 ranges |
| ▪ dc-current resolution | 0.01% of CR | 0.0183% of CR |
| ▪ dc-potential resolution | 96 μ V (gain 1)
48 μ V (gain 2)
19.2 μ V (gain 5)
9.6 μ V (gain 10)
4.8 μ V (gain 20) | 193 μ V (gain 1)
96.5 μ V (gain 2)
38.5 μ V (gain 5)
19.3 μ V (gain 10)
9.65 μ V (gain 20) |
| ▪ dc-current range | ± 3 times applied current range | |

FRA / EIS (impedance measurements)

- | | |
|----------------------|----------------------------------|
| ▪ frequency range | 10 μ Hz to 200 kHz |
| ▪ ac-amplitude range | 1 mV to 900 mV rms, or 2.5 V p-p |

Electrometer

- | | |
|-------------------|---|
| ▪ input impedance | > 1 T Ω // 10 pF |
| ▪ bandwidth | 10 kHz default or
500 kHz for EIS and fast CA/CP |

sensit™

Potentiostat / Galvanostat / Impedance Analyzer

WITH INTEGRATED

EmStat^{pico}™
Built with ANALOG DEVICES

- FRA / EIS up to 200 kHz
- Potential range: -1.7 V to +2 V
- Current ranges: 100 nA to 5 mA
- Ideal for use with a smartphone



Bluetooth

500 MB storage on-board

/BT™



MethodSCRIPT™

Works with MethodSCRIPT, see [page 13](#) for details.

- ⚡ Battery powered or USB
- 📏 75 x 55 x 23 mm
- ⚖️ 75 g
- 🔌 USB type C



/SMART™

- ⚡ USB powered
- 📏 43 x 25 x 11 mm
- ⚖️ 10 g
- 🔌 USB type C

Available configurations:

	SPE*	2 mm plugs
Sensit BT	Sensit BT.SPE	Sensit BT.SNS
Sensit Smart	Only available with SPE connector	

* Screen Printed Electrode

Specifications



Supported techniques on each channel

Voltammetric techniques

- Linear Sweep Voltammetry LSV
- Cyclic Voltammetry CV

Pulsed techniques

- Differential Pulse Voltammetry DPV
- Square Wave Voltammetry SWV
- Normal Pulse Voltammetry NPV

These methods can all be used in their stripping modes which are applied for (ultra-) trace analysis

Amperometric techniques

- Chronoamperometry CA
- Chronocoulometry CC
- Multistep Amperometry MA
- Pulsed Amperometric Detection PAD

Galvanostatic techniques

- Open Circuit Potentiometry OCP

Other

- Electrochemical Impedance Spectroscopy EIS
 - Potential scan
 - Fixed potential
 - Time scan

General	mode	Low Speed	High Speed	Max Range
dc-potential range		-1.2 to +2 V	-1.7 to +2 V	-1.7 to +2 V
compliance voltage		-2.0 to +2.3 V	-2.0 to +2.3 V	-2.0 to +2.3 V
maximum current		±3 mA	±3 mA	±3 mA
max. acquisition rate		100 pts/s	1000 pts/s	100 pts/s
supports FRA/EIS		No	Yes	No

Potentiostat (controlled potential mode)

- interface (BT) 2x SPE (1x WE, 1x RE and 1x CE each channel) or SNS (2x WE, 1x RE and 1x CE)
- interface (Smart) 1x SPE (1x WE, 1x RE and 1x CE)
- dc-potential resolution 537 μ V 395 μ V 932 μ V
- applied pot. accuracy < 0.2% < 0.5% < 0.5%
- current ranges

100 nA, 2 μ A,	100 nA, 1 μ A,	100 nA, 1 μ A,
4 μ A, 8 μ A,	6 μ A, 13 μ A,	6 μ A, 13 μ A,
16 μ A, 32 μ A,	25 μ A, 50 μ A,	25 μ A, 50 μ A,
63 μ A, 125 μ A,	100 μ A,	100 μ A,
250 μ A,	200 μ A, 1 mA,	200 μ A, 1 mA,
500 μ A, 1 mA,	5 mA	5 mA
- current accuracy

< 0.5 % for	< 1% for	< 1% for
current ranges	current ranges	current ranges
>100 nA,	>100nA	>100nA
< 2% for	< 2% for	< 2% for
100 nA	100nA	100nA
current range	current range	current range
- current resolution 0.006% of selected current range (5.5 pA on 100 nA range)
- potential resolution (for OCP) 56 μ V

FRA / EIS (impedance measurements)

- frequency range 0.016 Hz to 200 kHz
- ac-amplitude range 1 mV to 0.25 V rms, or 0.708 V p-p

Electrometer

- input impedance > 1 TOhm // 10 pF
- bandwidth 250 kHz

Control Sensit with
PSTrace for Windows



or with
PStouch for Android



or write your own code for Sensit in
Python, Visual Studio, Matlab or other environment or language

see pages 10, 12, 14 for more information

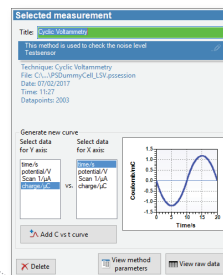
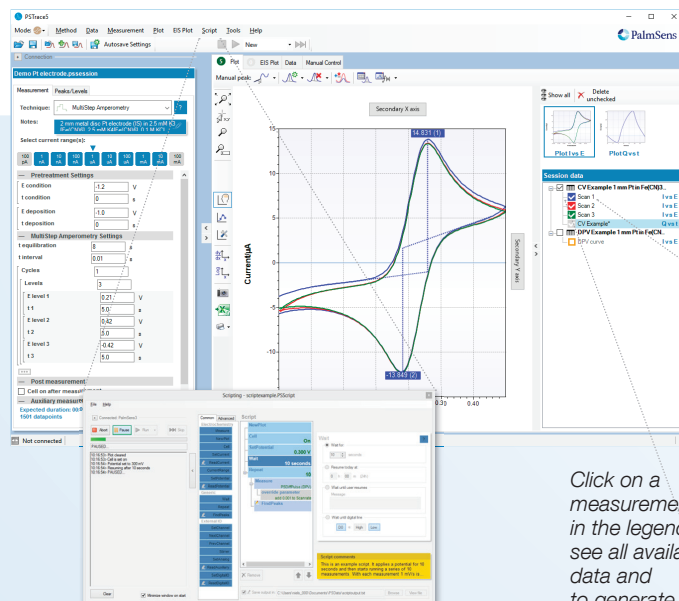
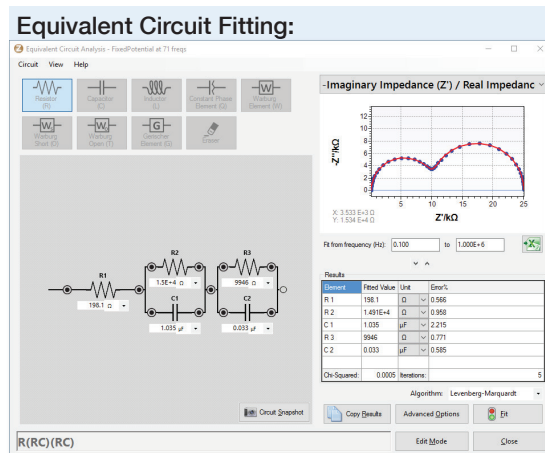
www.palmsens.com/bt
www.palmsens.com/smart



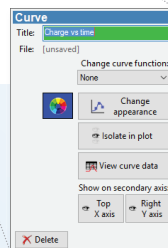
All our instruments come with the PSTrace software for Windows. PSTrace provides support for all techniques and instrument functionalities. The interface of PSTrace is designed to easily handle multiple curves in a single window.

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

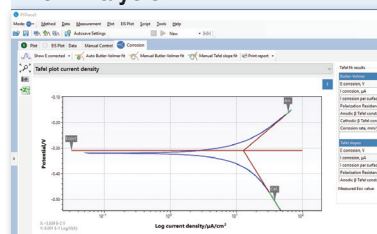


Click on a curve in the legend to change its title or appearance.

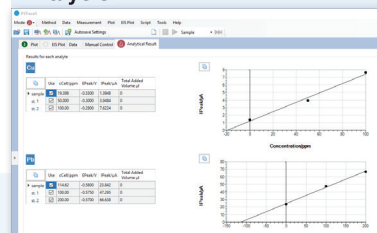


Click on a measurement in the legend to see all available data and to generate different curves.

Corrosion Mode, including Tafel Plot Analysis:



Analytical Mode, for Trace Analysis:



Script window for automated tasks, including:

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



A Software Development Kit with libraries and code examples is available. The libraries provide easy implementation, even for novice programmers. See page 14 for more details.



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

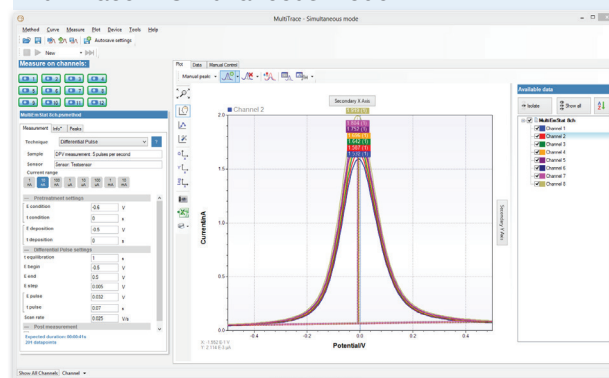
MultiTrace software controls all individual potentiostats. It is a dedicated program based on the PSTrace software for Windows (for PalmSens and EmStat instruments).

MultiTrace features two modes:

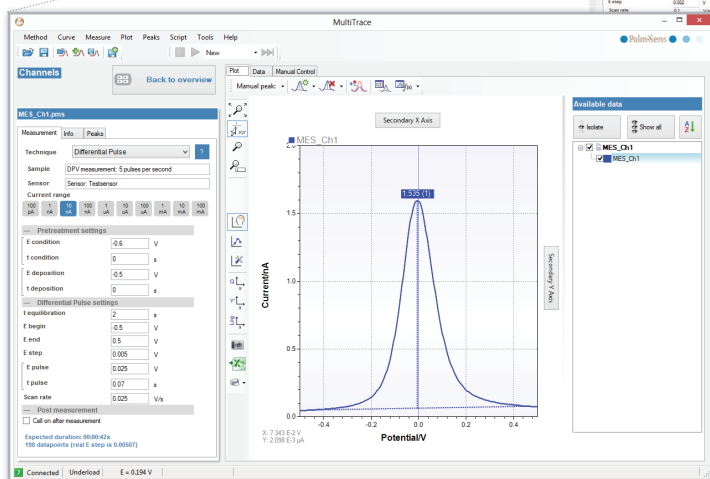
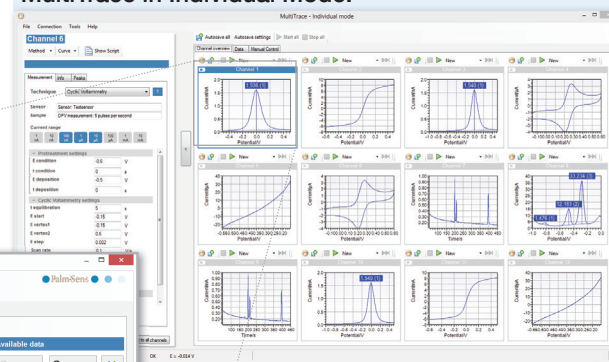
- **Simultaneous Mode:** use channels simultaneously
All potentiostats run the same measurement. The measured curves are displayed in a single plot and stored in a single data file.
- **Individual Mode:** use channels individually
All potentiostats are used independently. Each measurement can be different 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



PStouch is an app for Android devices that can be used with most of our potentiostats. PStouch can communicate with your potentiostat via USB* or via Bluetooth. All method and curve files are fully compatible with PSTrace software for Windows.

PStouch features:

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

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



PStouch is designed for use with tablets and smartphones.



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

MethodSCRIPT



MethodSCRIPT™

MethodSCRIPT™ is the language that our latest generation of potentiostats speak. It allows you to communicate directly with the potentiostat (module) from any operating system or embedded environment.

The MethodSCRIPT™ scripting language is designed to integrate our potentiostat (modules) effortlessly in your experiment setup or product.

No libraries needed

No DLLs or other type of code libraries are required for MethodSCRIPT™. It allows developers to program a human-readable script directly into the potentiostat (module). The simple script language allows for running all supported electrochemical techniques and makes it easy to combine different measurements and other tasks.

Script features include:

- Use of variables
- (Nested) loops
- Logging results to internal storage or an SD card
- Digital I/O. For example, to wait for an external trigger.
- Reading auxiliary values like pH or temperature
- Going to sleep or hibernate mode

Supported Devices:

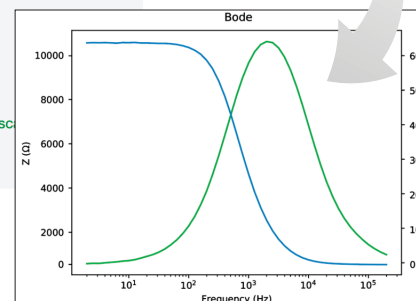
- EmStat Pico
- EmStat Pico Core
- Sensit BT
- Sensit Smart
- EmStat4 series

Code examples are available for:



Example MethodSCRIPT for running an EIS measurement:

```
e
#Declare variables
var h
var r
var j
#Initialize device
set_pgstat_mode 3
#Set starting current range
set_cr 1m
#Turn cell on for measurement
cell_on
#Start EIS scan from 200kHz to 2 Hz in 41 steps
meas_loop_eis h r j 10m 200k 2 41 0
#Send results of measurement loop step
pck_start
#Send frequency
pck_add h
#Send Z real
pck_add r
#Send Z imaginary
pck_add j
pck_end
#Continue with next step of EIS scan
endloop
#Turn cell off after measurement
cell_off
```



www.palmsens.com/methodscript

Software Development Kits



The power of PSTrace,
in a few lines of code

If you have some experience in writing software in C#, Visual Basic or another .NET language, our free Software Development Kits are a great solution for speeding up your research.

There are four PalmSens SDKs for .NET. Each SDK can be used with any of our instruments or OEM potentiostat modules to develop your own software. The SDKs come with a set of examples that shows how to use the libraries. PalmSens SDKs are available for the following .NET Frameworks: **WinForms**, **Xamarin (Maui)** and **WPF**.

For each .NET framework we provide examples that show how to:

- Connect to instruments
- Run measurements
- Control the cell manually
- Access and process measured data
- Analyze and manipulate data
- Do peak detection
- Do equivalent circuit fitting on impedance data
- Saving and loading data and method files
- And more

We also have examples showing how to use the libraries with **Matlab**, **LabVIEW** and **Python**.



MATLAB



www.palmsens.com/sdk

Knowledge Base

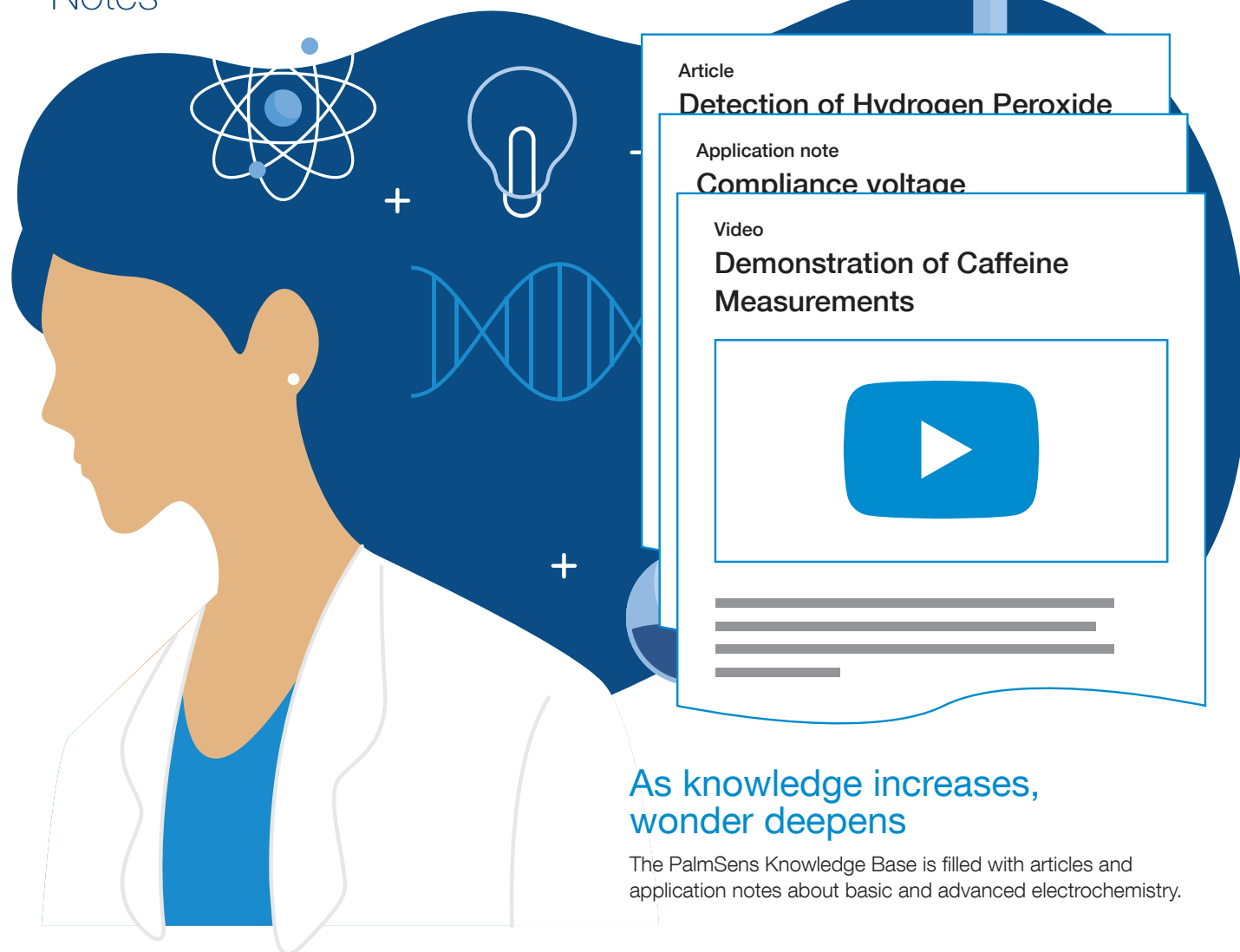
Corrosion
research

Electrochemistry
explained

Biosensors

Application
Notes

Scientific
publications



As knowledge increases,
wonder deepens

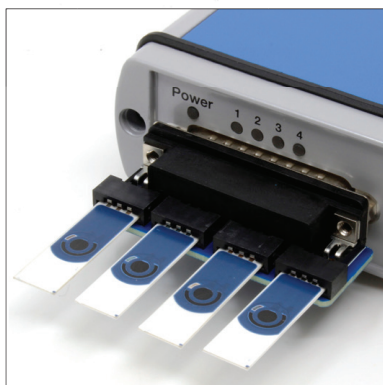
The PalmSens Knowledge Base is filled with articles and application notes about basic and advanced electrochemistry.

www.palmsens.com/kb

MUX8-R2™

Multiplexer for 8 up to 128 channels

- Automatically switch between electrochemical cells
- Easy stacking with magnetic feet and top
- Compatible with EmStat3 Blue, PalmSens4 and MultiPalmSens4



Our MUX8-R2 SPE adapter allows for easily connecting up to eight screen printed electrodes



Multiple MUX8-R2s can be stacked and daisy-chained to multiplex up to 128 channels

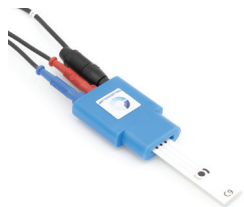
www.palmsens.com/mux8

Measurement	Peaks	Multiplexer
<input type="radio"/> No Multiplexer	<input checked="" type="radio"/> Consecutive	<input type="radio"/> Alternate
<small>only for</small> - Chronoamperometry - Chronopotentiometry - OCP - (G)EIS		
<input type="button" value="Invert"/>		
<input type="button" value="Select all"/>		
<input type="button" value="Select none"/>		
Channels		MUX8-R2 Settings
<input checked="" type="checkbox"/> Channel 1		<input type="checkbox"/> Connect Sense to WE
<input checked="" type="checkbox"/> Channel 2		<input type="checkbox"/> Combine RE and CE
<input checked="" type="checkbox"/> Channel 3		<input type="checkbox"/> Use Common RE and CE on Channel 1
<input type="checkbox"/> Channel 4		
<input type="checkbox"/> Channel 5		
<input checked="" type="checkbox"/> Channel 6		Unselected WE
<input checked="" type="checkbox"/> Channel 7		<input checked="" type="radio"/> Disconnect WE (floating)
<input type="checkbox"/> Channel 8		<input type="radio"/> Switch WE to GND

Configure the MUX8-R2 in PStace to run an automated sequence on a selection of channels

Accessories

A small selection of our accessories:



SPE connector for 2mm plug



Magnetic stirrer with switchbox



Differential Electrometer Amplifier



Coin cell battery connector



Glass Cell



LM35 temperature sensor



SPE connector



Flowcell

Available accessories for EmStat3 Blue, PalmSens4 and MultiPalmSens4

- **Magnetic stirrer:** Controlled by software for stripping analysis applications
- **Switch Box:** Simple switch with a relay that can be controlled by the software
- **LM35:** Temperature sensor
- **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 -5V to 5V (1x gain)
Possible gains are: 2x, 5x, 10x, 20x, 50x, 100x, etc

Accessories for sensors and electrodes

- **SPE connectors:** For various sensors and electrodes
- **Cells / Flow cells:** From different manufacturers

Starter Kits

Our Starter kits are a combination of instruments, sensors and/or cells, accessories and literature.



(EIS) Corrosion Kits

The corrosion packages combine nearly everything needed for corrosion analysis. The instrument included is either a PalmSens4 or EmStat4S, with EIS as an option. Together with our Corrosion Handbook and the Corrosion Cell Kit, it makes an ideal combination to get started with electrochemical corrosion studies.



Educational Kit

The PalmSens Educational Kit it is designed as the foundation for an electrochemistry course, lab class or similar teaching events. We combined our potentiostat with the necessary equipment and electrodes for a series of educational electrochemical experiments. The kit comes with a Teacher's and Student's guide.

www.palmsens.com/kits

Sensors and Electrodes

A small selection of our screen printed and classic electrodes:



ItalSens gold SPE



ItalSens carbon SPE



Ag/AgCl reference electrode



Platinum wire counter electrode



BVT-AC1 SPE



Integrated Graphene Gii-Sens



Classic metal disk electrode



BASI coiled platinum auxiliary electrode

Screen Printed Electrodes

A wide selection of Screen Printed Electrodes from different manufacturers can be ordered on our website.

Classic Electrodes

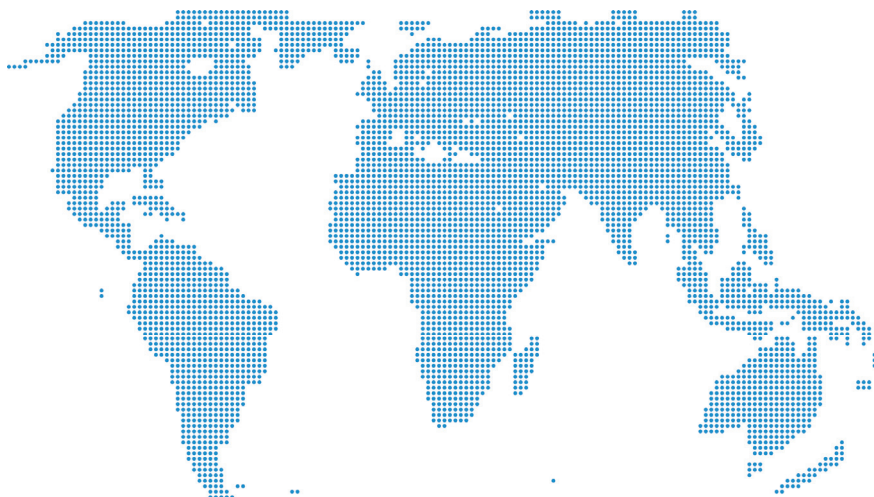
A wide selection of Classical Electrodes from different manufacturers can be ordered on our website.



www.palmsens.com/sensors

www.palmsens.com/electrodes

Worldwide distribution



All PalmSens BV instruments
come standard with a

3 YEAR WARRANTY

At PalmSens BV we are committed to making electrochemistry easier, more portable, and more accessible for novice and advanced researchers. We provide a comprehensive range of instruments for most types of electrochemistry with an emphasis on mobility. We manufacture the world's smallest commercially available potentiostat module with EIS capabilities: the EmStat Pico. While our unique flagship instrument, the PalmSens4, is one of the most versatile and compact frequency response analysis (FRA) / EIS capable device in the market.



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