SENSIT BT ™

Handheld and wireless dual-channel
potentiostat / impedance analyzer

WITH INTEGRATED
EmStat*pico*™
Built with ANALOG DEVICES

PalmSens

Rev. 11-2024-014

Contents

› See for more information:
www.palmsens.com/bt

Two Versions of the Sensit BT

Sensit BT.SPE

Two SPE Sensor connectors, compatible with most Screen-Printed Electrodes / Sensors.	
▪ sensor pitch	2.54 mm
▪ electrode connections	RE, WE, CE
▪ allowed sensor thickness	Between 0.1 mm and 0.8 mm
▪ maximum sensor width	11 mm

Sensit BT.SNS

With cable for connecting to any kind of electrochemical sensor or cell.	
▪ cable length	40 cm
▪ connectors	2 mm banana
▪ electrode connections	RE, WE, WE2, CE

software for

Sensit BT: with integrated EmStat Pico

The Sensit BT is built around the EmStat Pico module.

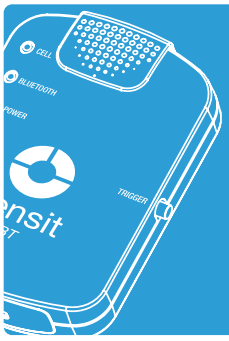
The EmStat Pico is a joint development by PalmSens BV and **Analog Devices Inc.** PalmSens is known for introducing the first commercially available handheld potentiostat. Together with Analog Devices, PalmSens has developed the EmStat Pico: the world's smallest electrochemical interface module.

WITH INTEGRATED EmStat pico™ Built with ANALOG DEVICES

www.palmsens.com/pico

Main Specifications

▪ power	USB / battery
▪ communication	USB (type C) and Wireless
▪ full dc-potential range	-1.7 V to +2 V
▪ EIS frequency range	0.016 Hz to 200 kHz
▪ current ranges	100 nA to 5 mA (max ±3 mA)
▪ current resolution	0.006% (5.5 pA on 100 nA range)
▪ dimensions	75 x 55 x 23 mm (excl. cable)
▪ weight	75 g
▪ battery life	12 hours at max. power consumption Full charge in < 3 hours
▪ storage memory	500 MB, equivalent to >15M datapoints



On-board data storage

The Sensit BT is equipped with 500 MB internal storage memory. Save measurements on-board as a backup. Or pre-program the device with a script and use the trigger button to run and store measurements: no need to connect a PC or smartphone.
Browse and transfer all internally stored measurements back to the PC easily using PSTrace for Windows.

Supported Techniques

The following electrochemical techniques are supported by the Sensit BT.

Voltammetric techniques:

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

The above techniques can also be used for stripping voltammetry

Techniques as a function of time:

- Chronoamperometry **CA**
- Pulsed Amperometric Detection **PAD**
- Open Circuit Potentiometry **OCP**
- MultiStep Amperometry **MA**

Electrochemical Impedance Spectroscopy:

- Scanning or fixed frequency mode **EIS**

MethodSCRIPT™ allows for developing custom techniques. See page 12 for more information.

MethodSCRIPT™ by PalmSens

Dual-channel and Bipotentiostat functionality

The Sensit BT.SPE can be used for running sequential measurements on two different Screen-Printed Electrodes (SPE's) each with their own Reference, Counter and Working electrodes. The second channel can also be used in bipotentiostat mode, functioning as second Working Electrode versus the Reference and Counter electrode of channel 1. Both Working electrodes are recorded simultaneously in the bipotentiostat mode.
The Sensit BT.SNS has a lead connected to the WE of channel 2 and can be used out-of-the-box for bipotentiostat measurements.

The second Working Electrode (WE2) can either be set at a potential offset with respect to WE1 or at a fixed potential with respect to RE1.

The bipotentiostat mode is supported in Low Speed mode (see table in next section) for all techniques, excluding EIS and OCP.

Full Specifications

The Sensit BT works in three different modes;

Low Speed mode: for scan rates up to 1 V/s or a bandwidth of 100 Hz.

High Speed mode: for high scan rates and frequencies.

Max Range mode: a combination of the Low and High Speed modes for optimal dynamic dc-potential range

The optimal mode is automatically selected in **PSTrace** for Windows and **PStouch** for Android, based on the selected technique and parameters.

General			
	Low Speed mode	High Speed mode	Max Range mode
▪ full dc-potential range	-1.2 to +2 V	-1.7 to +2 V	-1.7 to +2 V
▪ dynamic dc-potential range [1]	2.2 V	1.2 V	2.6 V
▪ compliance voltage	-2.0 to +2.3 V [2]		
▪ maximum current	±3 mA		
▪ max. acquisition rate (datapoints/s)	100	1000	100
▪ supports FRA/EIS	NO	YES	NO

Potentiostat (controlled potential mode)			
	Low Speed mode	High Speed mode	Max Range mode
▪ applied dc-potential resolution	537 µV	395 µV	932 µV
▪ applied potential accuracy	< 0.2%	< 0.5%	< 0.5%
▪ available current ranges	100 nA, 2 uA, 4 uA, 8 uA, 16 uA, 32 uA, 63 uA, 125 uA, 250 uA, 500 uA, 1 mA, 5 mA	100 nA, 1 uA, 6 uA, 13 uA, 25 uA, 50 uA, 100 uA, 200 uA, 1 mA, 5 mA	
▪ current accuracy	< 0.5% of current ±0.1% of range	< 1% of current ±0.1% of range [3]	
▪ measured current resolution	0.006% of selected current range (5.5 pA on 100 nA range)		
▪ measured potential resolution (for OCP)	56 µV		

[1] The dynamic range is the range that can be covered during a single scan within the full potential range. For example; a linear scan can start at -1.5 V and end at 1.1 V or vice versa, covering 2.6 V dynamic range.

[2] The compliance voltage is the maximum potential between Working and Counter electrode and depends on the selected mode.

[3] Channel 2 has an uncompensated series resistor (typical 110 Ω) in series with the WE2 signal. This additional resistance must be taken into account.

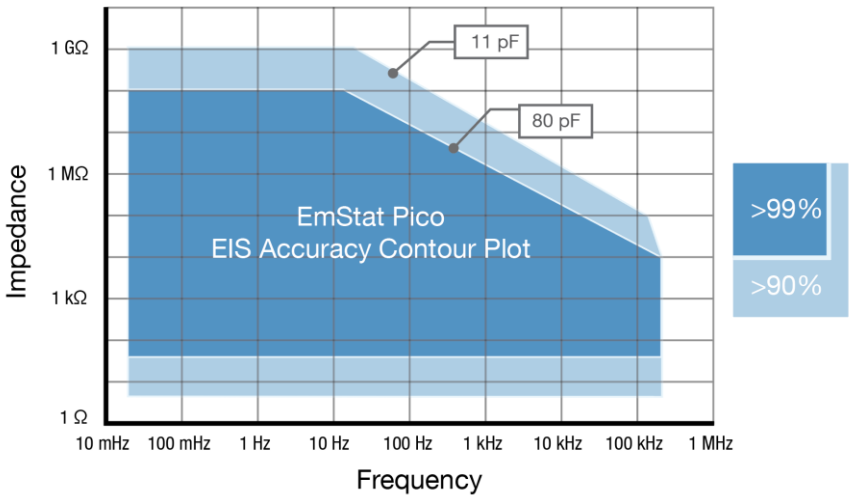
FRA / EIS (impedance measurements) in High Speed Mode only	
▪ frequency range	0.016 Hz to 200 kHz
▪ ac-amplitude range	1 mV to 0.25 V rms, or 0.708 V peak-peak (max. 64 mV for current ranges ≤ 1uA and ≥ 1mA)

Bipotentiostat	
▪ modes	1. WE2 at fixed potential (E offset vs RE1) 2. WE2 scanning (E offset vs WE1)
▪ max. potential WE2	ΔE(WE1) + ΔE(WE2) < 1.6 V [4]

Electrometer	
▪ electrometer amplifier input	> 1 TΩ // 10 pF
▪ bandwidth	250 kHz

Other	
▪ storage	500 MB on-board
▪ dimensions	75 x 55 x 23 mm (excl. cable)
▪ on-board temperature sensor	±0.25 °C
▪ operation temperature range	0 °C to +40 °C

EIS Accuracy Contour Plot



[4] If your main WE1 is scanning from -0.5V to +0.5V, the WE2 can only have a maximum offset of 0.6V.

Note
The Sensit BT works with the EmStat Pico potentiostat module.
The accuracy contour plot was determined on the first channel 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.

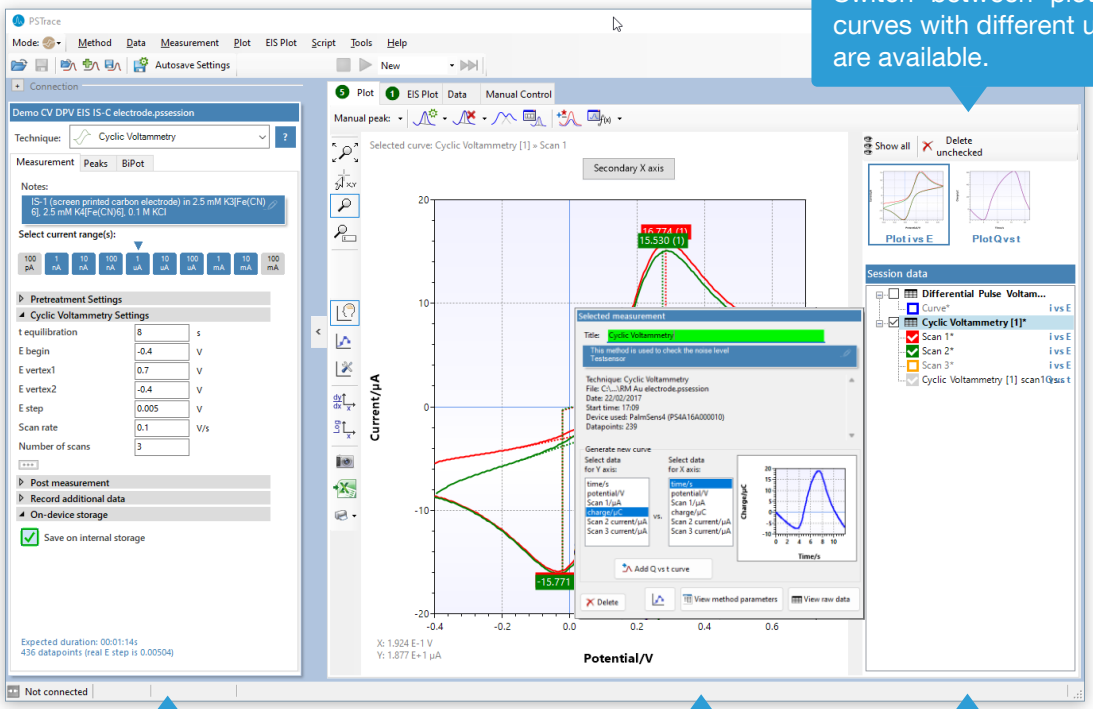
Standard Sensit BT Kit

Standard included with the Sensit BT.SPE:
- Rugged carrying case
- Dummy Cell SPE version
- 2x spare SPE connector
- USB-C cable
- Quick Start
- PSTrace software on USB stick
- PSTrace Manual
- Access to software on my.palmsens.com
- 3-year warranty

Standard included with the Sensit BT.SNS:
- Rugged carrying case
- Dummy Cell
- 5x croc clips
- USB-C cable
- Quick Start
- PSTrace software on USB stick
- PSTrace Manual
- Access to software on my.palmsens.com
- 3-year warranty

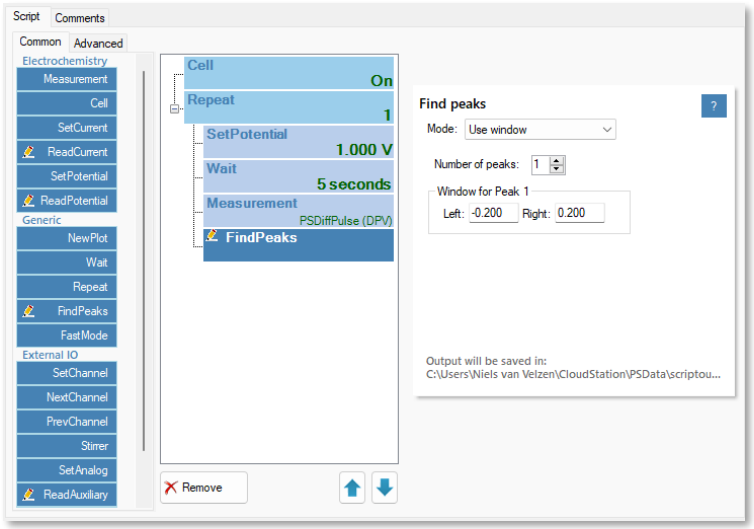
PSTrace: Software for Windows

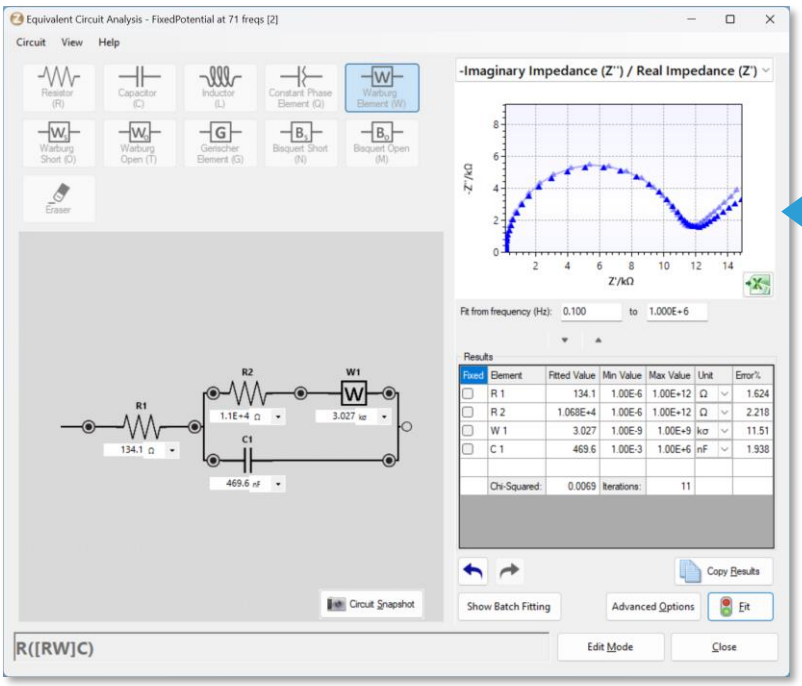
PSTrace is designed to get the most out of your instrument right after installation, without going through a long learning period. It has three modes; the Scientific mode which allows you to run all the techniques our instruments have to offer, and two dedicated modes for Corrosion analysis and the Analytical Mode. The Analytical Mode is designed for use with (bio)sensors and allows you to do concentration determinations. Extensive help files and prompts guide the user through a typical analysis.



Scripting

The intuitive script editor allows for easily creating a sequence of measurements or other tasks, by means of dragging and dropping actions in a list.





Use the graphical editor to draw the equivalent circuit or enter the CDC directly.

Other functions in PSTrace

- Concentration determination
- Advanced peak search algorithms
- 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
- Load measurements from the internal instrument storage
- Direct validation of method parameters
- Run custom MethodSCRIPTS™

Integration with third party software

- Excel
- Origin
- Matlab
- ZView

Minimum System Requirements

- Windows 7, 8, 10 or 11
- 1 GHz or faster 32-bit (x86) or 64-bit (x64) processor
- 2 GB RAM (32-bit) or 4 GB RAM (64-bit)
- Screen resolution of 1280 x 800 pixels

› See for more information:
www.palmsens.com/pstrace

PStouch: App for Android

PStouch

GET IT ON Google Play

PStouch is an app for Android devices compatible with all PalmSens, EmStat and Sensit potentiostats.

PStouch features:

- Setting up and running measurements
- Loading and saving measured curves
- Analysing and manipulating peaks
- Sharing measurement data directly via any service like email or Dropbox
- Concentration determination by means of Standard Addition or Calibration Curve
- Support for PalmSens accessories such as a Multiplexer or Stirrer
- All method and curve files are fully compatible with PSTrace software for Windows.

› See for more information:
www.palmsens.com/pstouch

Sensit BT works with MethodSCRIPT™

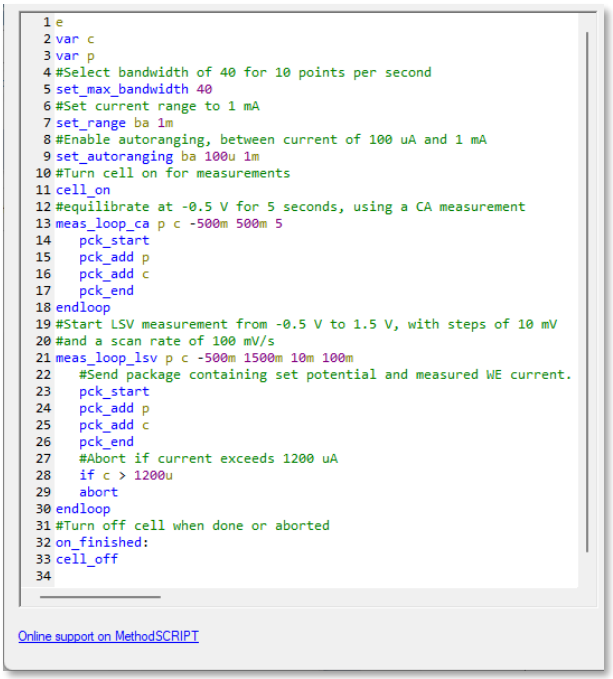
The MethodSCRIPT™ scripting language is designed to integrate our instruments and potentiostat (modules) effortlessly in your hardware setup, product, or experiment.

MethodSCRIPT™ gives you full control over your potentiostat. The simple script language is parsed on-board the instrument and allows for running all supported electrochemical techniques, making it easy to combine different measurements and other tasks.

MethodSCRIPT can be generated, edited, and executed in PSTrace.

MethodSCRIPT features include:

- Use of variables
- (Nested) loops and conditional logic support
- User code during a measurement iteration
- Exact timing control
- Simple math operations on variables (add, sub, mul, div)
- Digital I/O, for example for waiting for an external trigger
- Logging results to internal storage or external SD card
- Reading auxiliary values like pH or temperature
- and many more..



```
e
var c
var p
#Select bandwidth of 40 for 10 points per second
set_max_bandwidth 40
#Set current range to 1 mA
set_range ba 1m
#Enable autoranging, between current of 100 uA and 1 mA
set_autoranging ba 100u 1m
#Turn cell on for measurements
cell_on
#equilibrate at -0.5 V for 5 seconds, using a CA measurement
meas_loop_ca p c -500m 500m 5
   pck_start
   pck_add p
   pck_add c
   pck_end
endloop
#Start LSV measurement from -0.5 V to 1.5 V, with steps of 10 mV
#and a scan rate of 100 mV/s
meas_loop_lsv p c -500m 1500m 10m 100m
   #Send package containing set potential and measured WE current.
   pck_start
   pck_add p
   pck_add c
   pck_end
   #Abort if current exceeds 1200 uA
   if c > 1200u
   abort
endloop
#Turn off cell when done or aborted
on_finished:
cell_off

```

Online support on MethodSCRIPT

Write your own software and integrate (generated) MethodSCRIPTs. No libraries needed.

MethodSCRIPT is parsed on-board the instrument. No DLLs or other type of code libraries are required for using MethodSCRIPT™

MethodSCRIPT™

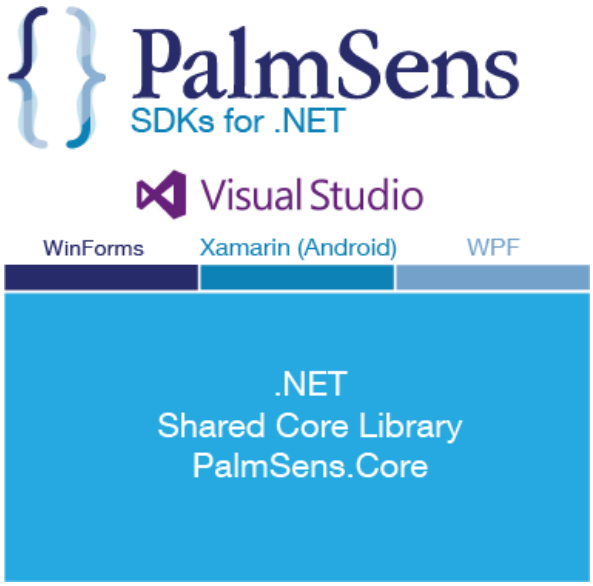
Code examples are available for:

C/C++ ARDUINO Swift Xamarin python Java

› See for more information:
www.palmsens.com/methodscript

Software Development Kits for .NET

Develop your own application in no time for use with any PalmSens instrument or potentiostat (module). Our SDKs are free of charge.



There are three PalmSens Software Development Kits (SDKs) for .NET. Each SDK can be used with any of our instruments or OEM potentiostat modules to develop your own software. The SDK's come with a set of examples that shows how to use the libraries. PalmSens SDKs with examples are available for the following .NET Frameworks:

- WinForms
- Xamarin (Android)
- WPF

Each SDK comes with code examples for:

- Connecting
- Running measurements and plotting data
- Manual control of the cell
- Accessing and processing measured data
- Analyzing and manipulating data
- Peak detection
- Equivalent Circuit Fitting on impedance data
- Saving and loading files

```
/// <summary>
/// Initializes the EIS method.
/// </summary>
1 reference
private void InitMethod()
{
    _methodEIS = new ImpedimetricMethod();
    _methodEIS.ScanType = ImpedimetricMethod.enumScanT
    _methodEIS.Potential = 0.0f; //0.0V DC potential
    _methodEIS.Eac = 0.01f; //0.01V RMS AC potential a
    _methodEIS.FreqType = ImpedimetricMethod.enumFrequ
    _methodEIS.MaxFrequency = 1e5f; //Max frequency is
    _methodEIS.MinFrequency = 10f; //Min frequency is
    _methodEIS.nFrequencies = 11; //Sample at 11 diffe

    _methodEIS.EquilibrationTime = 1f; //Equilabrates
    _methodEIS.Ranging.StartCurrentRange = new Current
    _methodEIS.Ranging.MinimumCurrentRange = new Curre
    _methodEIS.Ranging.MaximumCurrentRange = new Curre
}
```

› See for more information:
www.palmsens.com/sdk

Sensit BT Customization Options for OEM

The Sensit BT can be re-branded for OEM purposes.
Contact us about the possibilities.

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

PalmSens BV
The Netherlands
www.palmsens.com