

ECA-5M / ECA-500k / ECA-Zero

Potentiostats and Impedance Analysers



Representative ECA-5M image; all three models use the same enclosure.

Features

Three focused models 5 MHz EIS, 500 kHz EIS, or DC-focused potentiostat operation

Configuration 1 channel, 3-electrode; WE, RE, CE and GND

Power and host Single USB-C connection; 5 V, 200 mA maximum

Potential ± 2 V applied/measured and compliance; 0.001 mV resolution, ± 0.1 mV accuracy

Current ± 50 mA measurement/continuous output

Current measurement ranges ± 50 mA, ± 2 mA, ± 20 μ A, ± 100 nA, ± 10 nA and ± 1 nA

Minimum resolved current step 0.1 pA on the ± 1 nA range

Acquisition 24-bit ADC

EIS bandwidth 10 μ Hz to 5 MHz or 500 kHz, depending on model

AC excitation 1 mV to 350 mV RMS with 0.1 mV resolution

EIS signal chain 80 MSPS or 25 MSPS DAC, analogue lock-in; multi-sine with 2–10 tones up to 10 Hz

Multi-sine control User-selectable tones with logarithmic spacing and crest-factor optimisation

Cell interface Four supplied 30 cm stackable banana plug leads

Mechanical 86 $\times$ 57 $\times$ 23 mm aluminium enclosure

Software Sensitify Studio for Windows, macOS and Linux

Data analysis Circuit fitting, automatic peak detection, charge integration and digital filtering

Data export CSV, TXT/ASCII, XLSX, MATLAB MAT, PNG and PDF

Software licence Included; no subscription or account required

Multi-instrument operation Multiple instruments on one computer

Python SDK Programmatic instrument access; application-specific protocols developed on request

Methods

Cyclic Voltammetry (CV)

Linear Sweep Voltammetry (LSV)

Differential Pulse Voltammetry (DPV)

Square Wave Voltammetry (SWV)

Normal Pulse Voltammetry (NPV)

Amperometry

Chronoamperometry (CA)

Open Circuit Potential (OCP)

Electrochemical Impedance Spectroscopy (5M / 500k)

Model Highlights

ECA-5M - maximum EIS bandwidth

EIS from 10 μ Hz to 5 MHz, an 80 MSPS DAC and analogue lock-in acquisition.

ECA-500k - routine impedance work

EIS from 10 μ Hz to 500 kHz with a 25 MSPS DAC and analogue lock-in acquisition.

ECA-Zero - DC-optimised front-end

A DC-optimised analogue front-end with 24-bit acquisition for DC techniques, including CV, amperometry and OCP; no EIS hardware.

Applications

- Electrochemical sensor development
- Corrosion measurements
- Broadband impedance analysis

Specifications are common to all three models unless otherwise stated. Accuracy values apply under the operating and calibration conditions listed below.

Model Comparison

Specification	ECA-5M	ECA-500k	ECA-Zero
Mode	Potentiostat + EIS	Potentiostat + EIS	Potentiostat
EIS frequency range	10 μ Hz to 5 MHz	10 μ Hz to 500 kHz	Not available
DAC sampling rate	80 MSPS	25 MSPS	Not applicable
Multi-sine EIS	2–10 tones, 10 Hz max	2–10 tones, 10 Hz max	Not available
Analogue lock-in	Supported	Supported	Not applicable

Common Potentiostat Specifications

Specification	ECA-5M	ECA-500k	ECA-Zero
Power input	USB 5 V	USB 5 V	USB 5 V
Maximum input current	200 mA	200 mA	200 mA
Applied potential range	± 2 V	± 2 V	± 2 V
Measurable cell potential range	± 2 V	± 2 V	± 2 V
Compliance voltage	± 2 V	± 2 V	± 2 V
Potential resolution	0.001 mV	0.001 mV	0.001 mV
Potential accuracy	± 0.1 mV	± 0.1 mV	± 0.1 mV
Current range	± 50 mA	± 50 mA	± 50 mA
Selectable current ranges	± 50 mA, ± 2 mA, ± 20 μ A, ± 100 nA, ± 10 nA and ± 1 nA		
Minimum resolved current step	0.1 pA on the ± 1 nA range		
Maximum continuous output current	± 50 mA	± 50 mA	± 50 mA
Maximum scan rate	0.3 V/s with a 1 mV potential step		
ADC	24-bit	24-bit	24-bit
Galvanostat mode	Not available	Not available	Not available
Onboard storage	Not available	Not available	Not available

Current Measurement Accuracy

Range	Accuracy	Range	Accuracy
± 50 mA	$\pm 0.1\%$ of range	± 100 nA	$\pm (0.2\% \text{ of range} + 20 \text{ pA})$
± 2 mA	$\pm 0.1\%$ of range	± 10 nA	$\pm (0.5\% \text{ of range} + 2 \text{ pA})$
± 20 μ A	$\pm 0.2\%$ of range	± 1 nA	$\pm (1\% \text{ of range} + 0.5 \text{ pA})$

Connections, Operating and Calibration Conditions

Channels	1
Cell configuration	3-electrode
Cell connections	WE, RE, CE and GND
Cell interface and leads	Stackable banana plugs with four 30 cm leads
Operating temperature	10–35 °C
Specification condition	23 $\pm$ 5 °C after factory calibration, using the supplied 30 cm stackable banana plug leads
Warm-up time	No defined warm-up period required
Factory calibration	Performed on every instrument
Calibration coefficients	Stored internally
Final functional verification	Performed before shipment

Supported Measurement Techniques

Technique	ECA-5M	ECA-500k	ECA-Zero
Cyclic Voltammetry (CV)	Supported	Supported	Supported
Linear Sweep Voltammetry (LSV)	Supported	Supported	Supported
Differential Pulse Voltammetry (DPV)	Supported	Supported	Supported
Square Wave Voltammetry (SWV)	Supported	Supported	Supported
Normal Pulse Voltammetry (NPV)	Supported	Supported	Supported
Amperometry	Supported	Supported	Supported
Chronoamperometry (CA)	Supported	Supported	Supported
Open Circuit Potential (OCP)	Supported	Supported	Supported
Electrochemical Impedance (EIS)	To 5 MHz	To 500 kHz	Not available
Multi-sine EIS	Supported	Supported	Not available
Galvanostatic techniques	Not available	Not available	Not available

Selection Guide

ECA-5M

Choose for high-frequency EIS, low-capacitance devices, biosensors, thin films and circuits where measurements above 500 kHz matter.

Key differentiator: 5 MHz EIS and 80 MSPS DAC.

ECA-500k

Choose for routine impedance measurements and research that does not require operation above 500 kHz.

Key differentiator: 500 kHz EIS and 25 MSPS DAC at a lower entry point than ECA-5M.

ECA-Zero

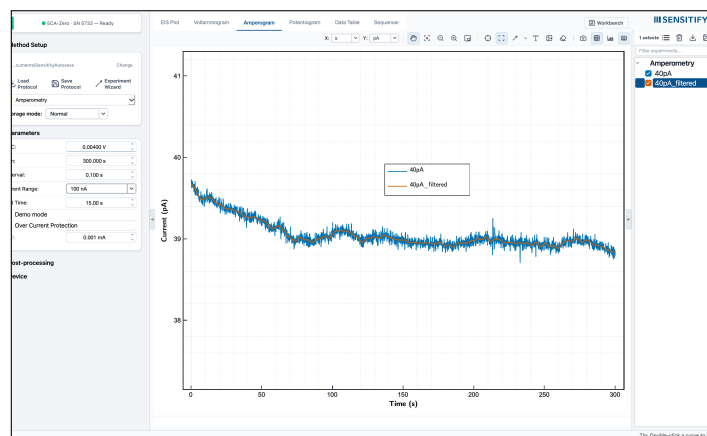
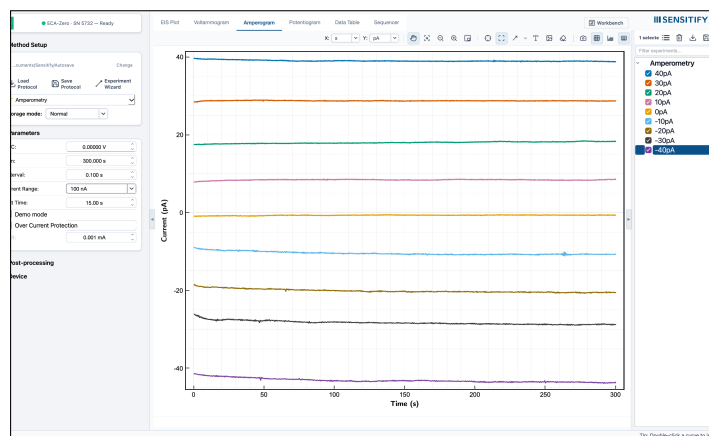
Choose for DC electrochemical measurements such as voltammetry, amperometry and open-circuit potential when EIS is not required.

Key differentiator: DC-optimised analogue front-end with 24-bit acquisition, without EIS hardware.

Shared Platform

All three instruments use USB-C power, the same ± 2 V potential and ± 50 mA current ranges, a 24-bit ADC and Sensify Studio. Their shared platform provides a consistent measurement and software workflow while offering two EIS bandwidth options and one DC-focused configuration. ECA-LP1 is a separate product platform and is documented separately.

pA-Level DC Current Measurement Examples



Sensify Studio amperometry traces recorded with ECA-Zero. Test currents were generated by applying controlled bias voltages across a 100 M Ω resistor; for example, 1 mV corresponds to 10 pA. Left: nominal current levels from -40 pA to $+40$ pA in 10 pA steps. Right: a nominal 40 pA trace before and after digital filtering. The plots are measurement examples, not accuracy specifications.

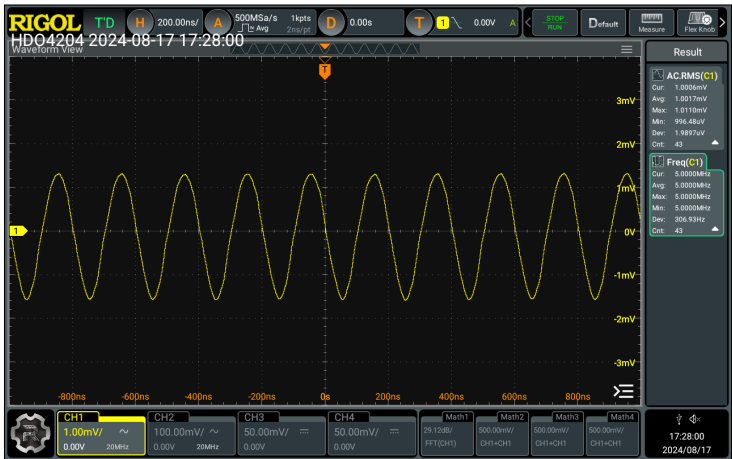
EIS Parameters

Specification	ECA-5M	ECA-500k	ECA-Zero
Frequency range	10 μ Hz to 5 MHz	10 μ Hz to 500 kHz	Not available
AC excitation range	1 to 350 mV RMS	1 to 350 mV RMS	Not applicable
AC excitation resolution	0.1 mV	0.1 mV	Not applicable
Frequency resolution	10 μ Hz to 0.3 mHz	10 μ Hz to 0.3 mHz	Not applicable
DAC sampling rate	80 MSPS	25 MSPS	Not applicable
Signal acquisition	24-bit ADC + analogue lock-in	24-bit ADC + analogue lock-in	Not applicable
Multi-sine EIS	2–10 tones, 10 Hz max	2–10 tones, 10 Hz max	Not available

Multi-sine details. Individual tone frequencies are user-selectable with logarithmic spacing support. Total excitation is 1 mV to 350 mV RMS for the complete waveform. Crest-factor optimisation, Schroeder/random/zero phase strategies and digital multi-sine detection are supported.

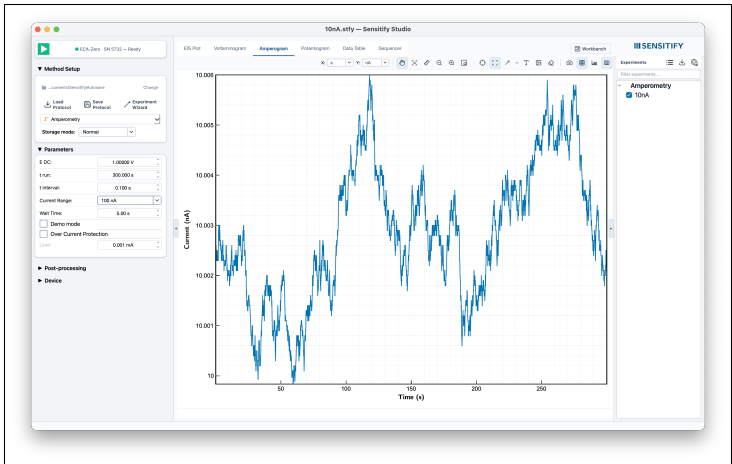
Performance Examples

5 MHz signal generation



Oscilloscope capture of a nominal 5 MHz, 1 mV RMS waveform generated by ECA-5M. This is a signal-generation example, not an accuracy specification.

10 nA DC current measurement

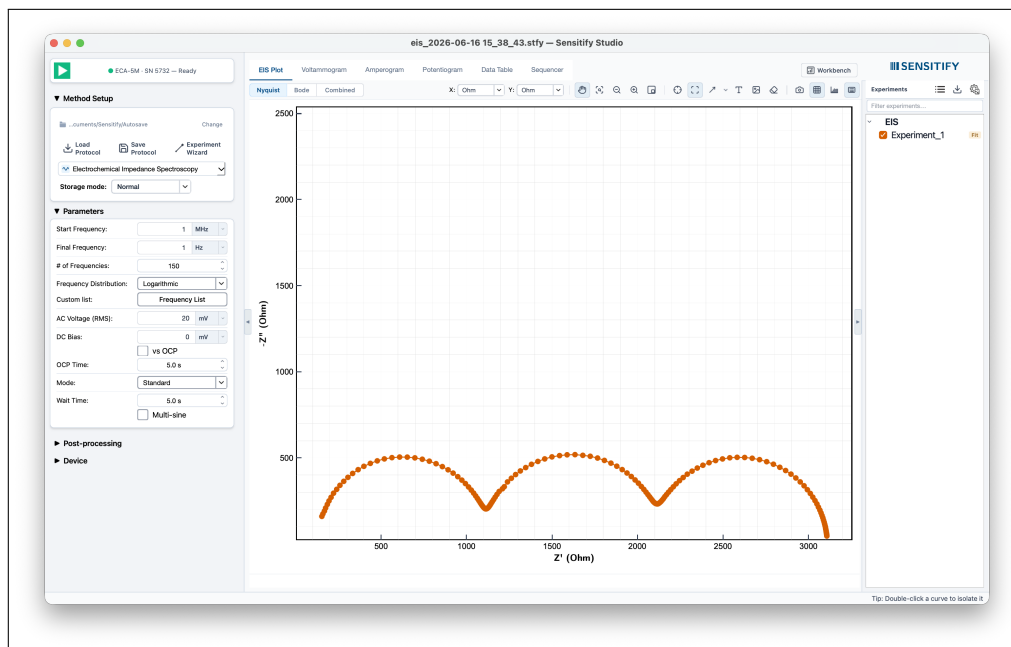


Sensify Studio amperometry trace recorded with ECA-Zero at a nominal 10 nA current level. The test current was generated by applying 1 V across a 100 M Ω resistor; acquisition used the 100 nA range, a 0.1 s sampling interval and a 300 s run time. The plot illustrates stable DC current acquisition under the displayed measurement settings; it is not an accuracy specification.

From Measurement to Equivalent Circuit

Sensitify Studio carries the same EIS dataset from acquisition and inspection through automatic model ranking and equivalent-circuit fitting.

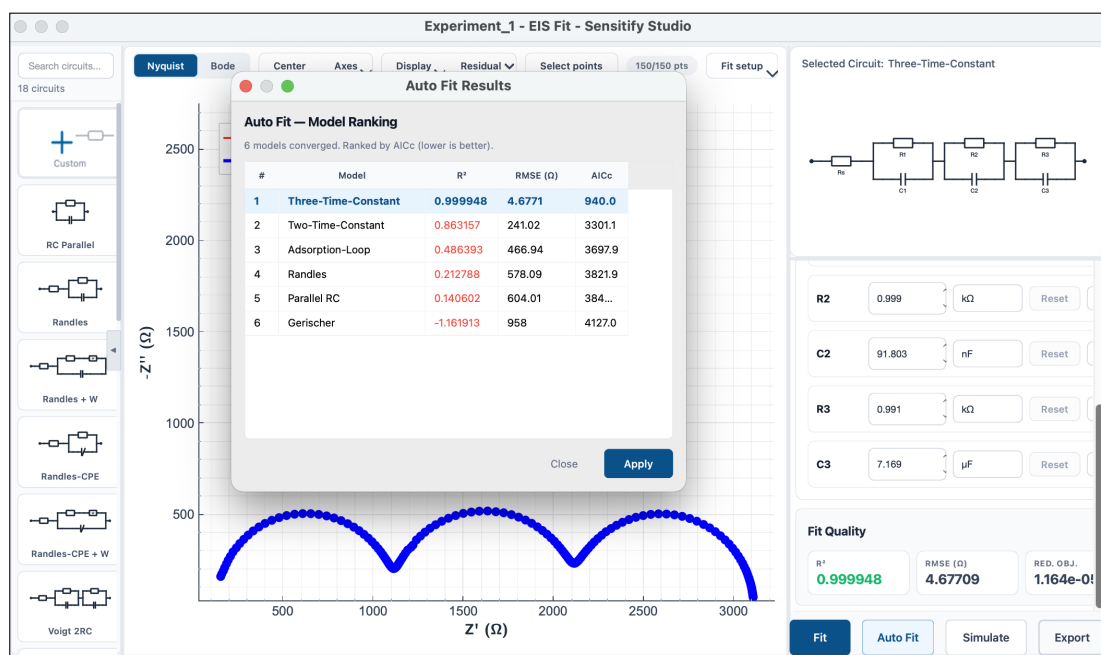
1. Acquire the impedance spectrum



Measurement conditions. ECA-5M, 1 Hz to 1 MHz, 150 logarithmically spaced frequencies, 20 mV RMS excitation and 0 mV DC bias. The Nyquist plot demonstrates three clearly resolved impedance arcs; it is not an accuracy specification.

Measurement data → model ranking → fitted equivalent circuit

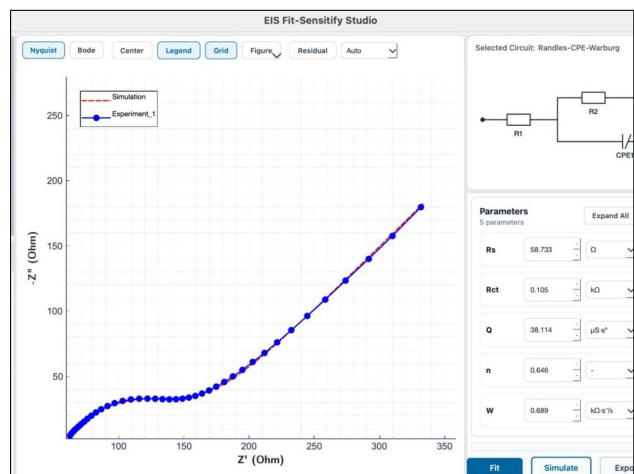
2. Rank and fit equivalent-circuit models



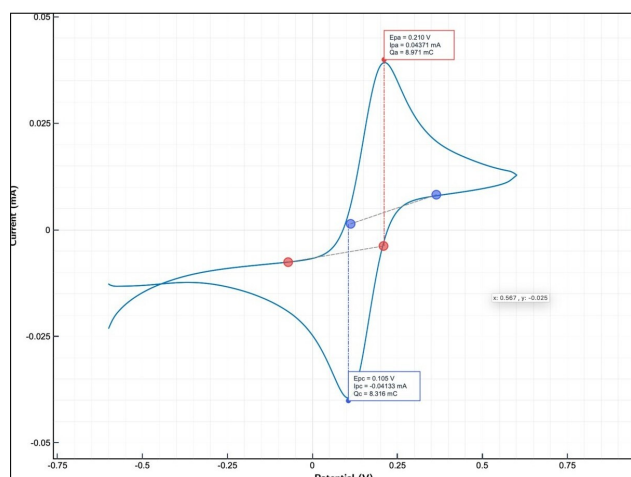
Fit result. Automatic model ranking of the displayed dummy-cell dataset selected a three-time-constant circuit with $R^2 = 0.999948$ and an RMSE of 4.6771 Ω . The reported metrics apply only to this measurement.

Sensitify Studio

Sensitify Studio is the measurement and analysis application used with all three instruments. It supports Windows, macOS and Linux. A software licence is included; no subscription or account is required, and no separate USB driver is needed.



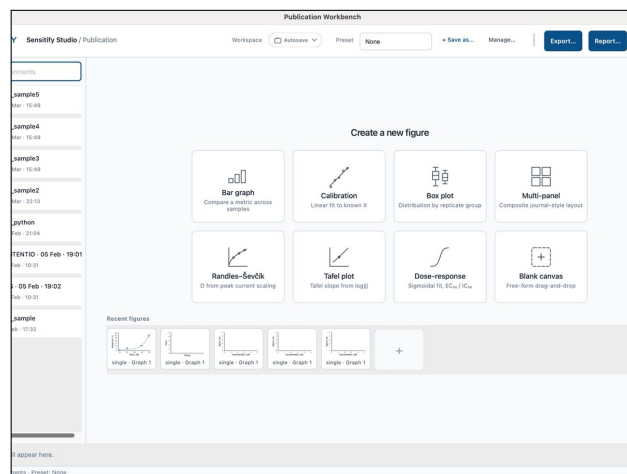
Equivalent-circuit fitting



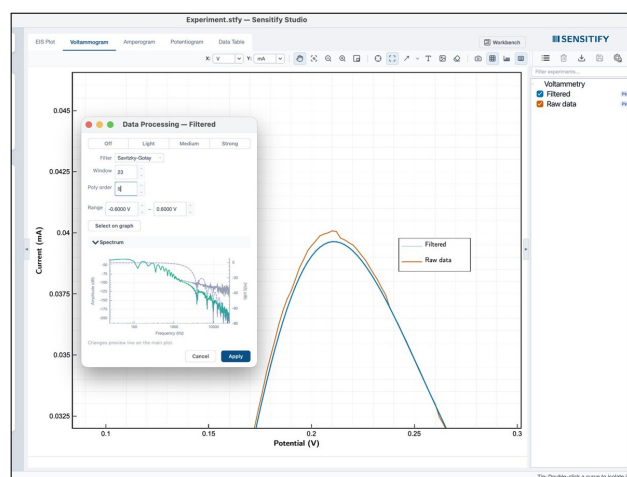
Automatic voltammetry peak detection

Analysis and Workflow

- Equivalent-circuit fitting
- Automatic peak-current and peak-potential detection
- Charge integration and calibration workflows
- Digital filtering and preview
- Application-specific measurement protocols developed on request
- Publication-ready plots and figure export



Publication Workbench



Digital filtering preview

Software Compatibility

Device support	ECA-5M, ECA-500k and ECA-Zero
Operating systems	Windows, macOS and Linux
Licence	Included
Driver	No separate driver required
Account	Not required
Subscription	Not required
Data export	CSV, TXT/ASCII, XLSX, MATLAB MAT, PNG and PDF
Python SDK	Available
Firmware update	USB bootloader
Multiple instruments	Supported on one computer

Safety and Intended Use

For research and laboratory use only. Not intended for clinical diagnostic, medical, life-support or other safety-critical applications.

Power and host communication share the same USB-C connection. Disconnecting USB-C removes instrument power and stops any active experiment.

When testing rechargeable batteries or other high-energy cells, use appropriate external protection, monitoring and containment. These instruments do not replace a battery-management or cell-safety system.

Ordering Information

ECA-5M	Potentiostat / impedance analyser, 5 MHz EIS
ECA-500k	Potentiostat / impedance analyser, 500 kHz EIS
ECA-Zero	Potentiostat, without EIS
Hardware revision	v1.5
Software	Sensitify Studio
Document revision	Rev. 1.0

Accessories & Spares

Spare banana plug leads	Set of four 30 cm stackable leads
Spare USB-C cable	USB-C power and host cable
Electrode test fixture	Replacement test fixture
SPE fixture	For screen-printed electrodes
IDE fixture	For interdigitated and thin-film electrodes
Dummy cell	Replacement for functional checks
Interdigitated gold electrodes	Pack of 50

In the Box



1 Carrying case

2 USB-C cable

3 Selected ECA instrument

4 Four 30 cm stackable banana plug leads

5 Four detachable crocodile clips

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