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Find the *Metrohm / Eco Chemie Autolab MAC80012* at our website: ***Click HERE***

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Metrohm Autolab

Instruments for Electrochemistry

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History of Metrohm Autolab

- Founded in 1986 as Eco Chemie in Utrecht
- Develops state of the art instruments for electrochemistry
- Joined the Metrohm group in 1999
- Name changed to Metrohm Autolab in 2009

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Metrohm Group





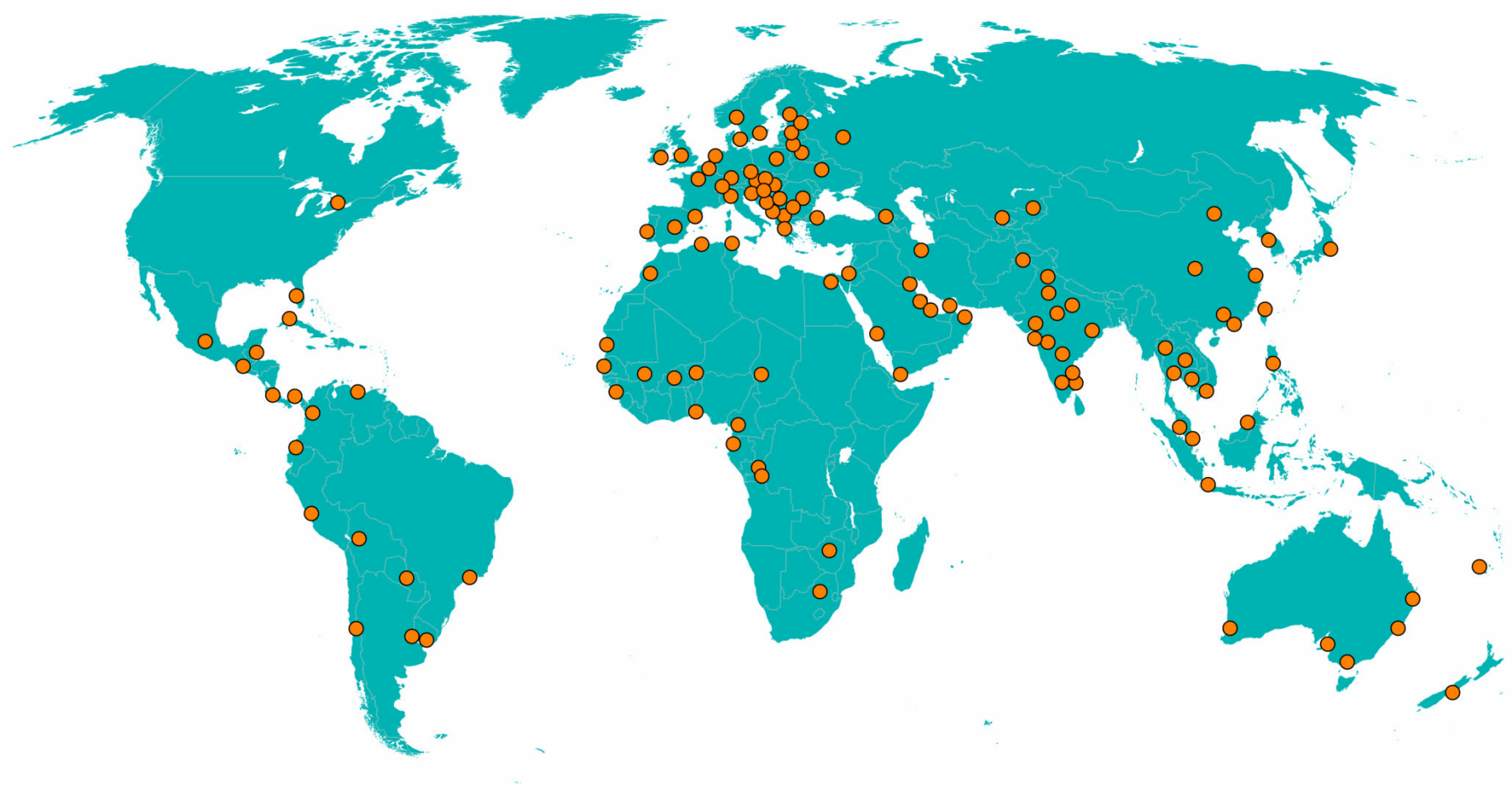






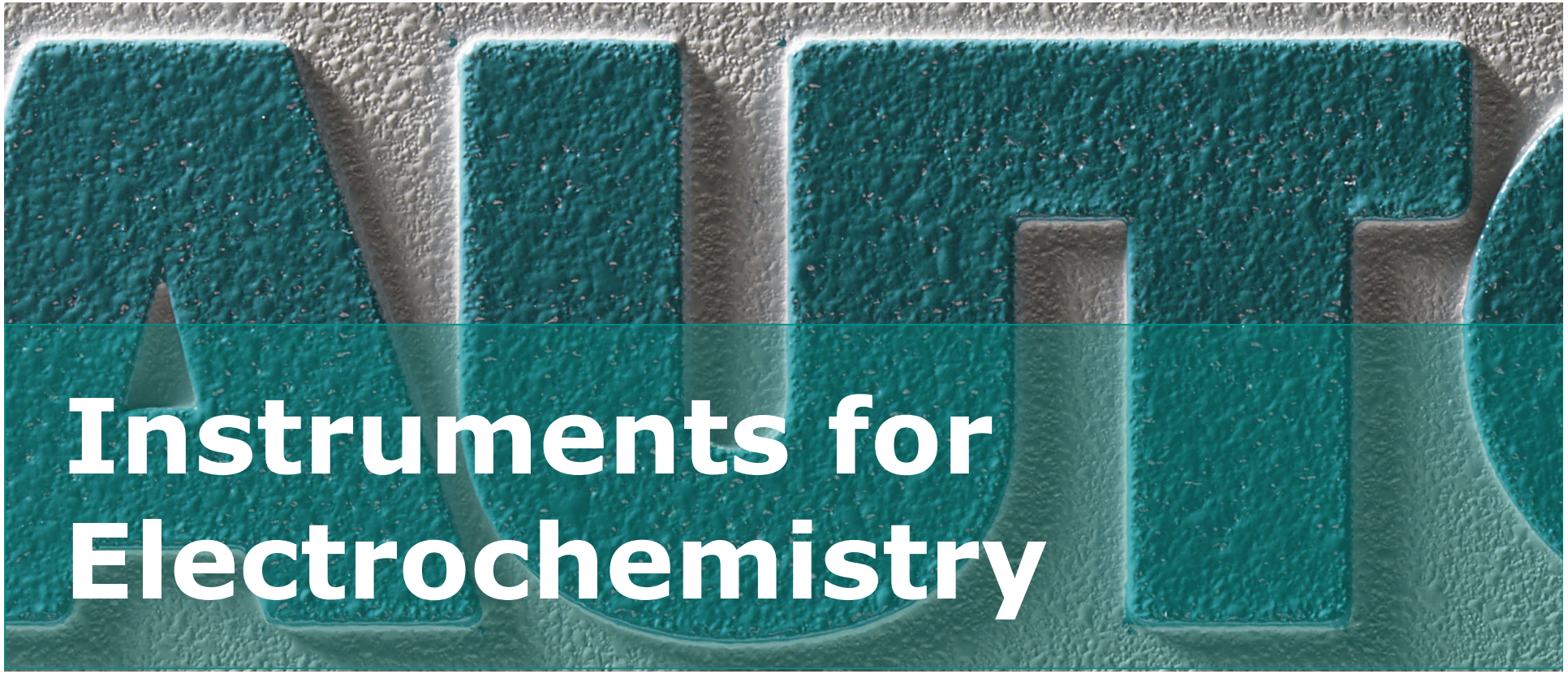
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International presence



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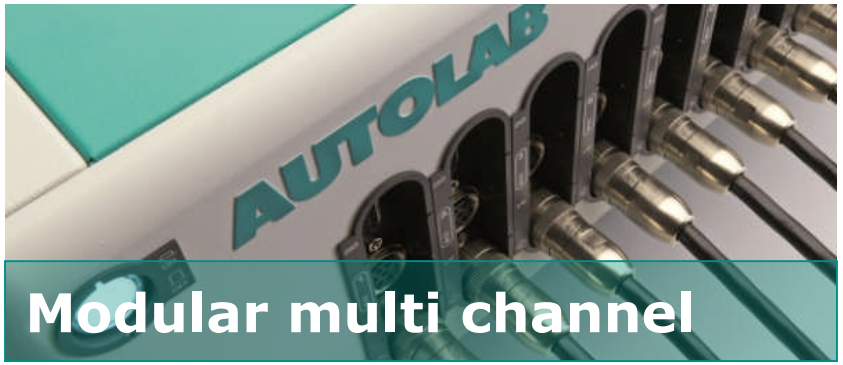
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Four instrument ranges



Modular single channel



Modular multi channel



Compact design



Special applications

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Single Channel, Modular

State of the Art, Future Proof Instruments

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Single channel, modular

- N series of Autolab instruments
- Potentiostat/Galvanostat with USB
- Module bays for instrument extensions



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The N series of PGSTATs

- Three models available



PGSTAT128N
12 V / 800 mA



PGSTAT302N
30 V / 2 A



PGSTAT100N
100 V / 250 mA

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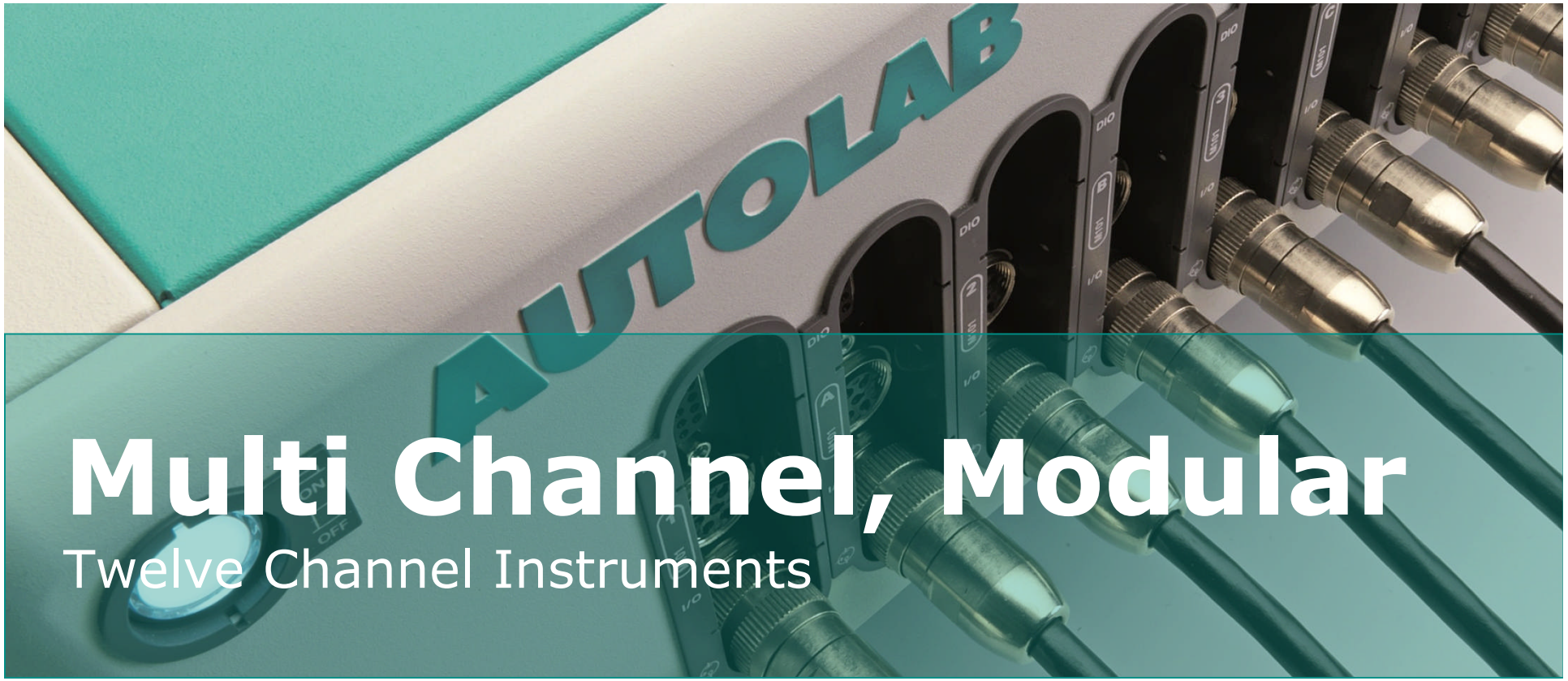
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N Series Summary

	PGSTAT128N	PGSTAT302N	PGSTAT100N
Compliance voltage	12 V	30 V	100 V
Maximum current	800 mA	2 A	250 mA
Bandwidth	500 kHz	1 MHz	400 kHz

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Multi Channel, Modular

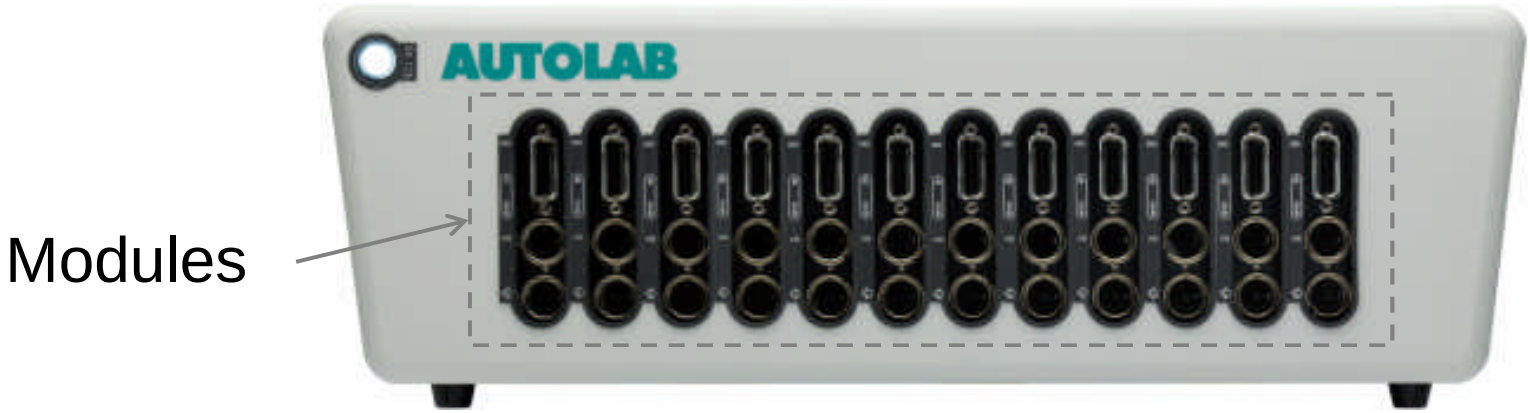
Twelve Channel Instruments

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Multi channel, modular

- 12 channel cabinet with USB
- Fitted with M101 PGSTAT modules
- Fitted with optional modules



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M101 module



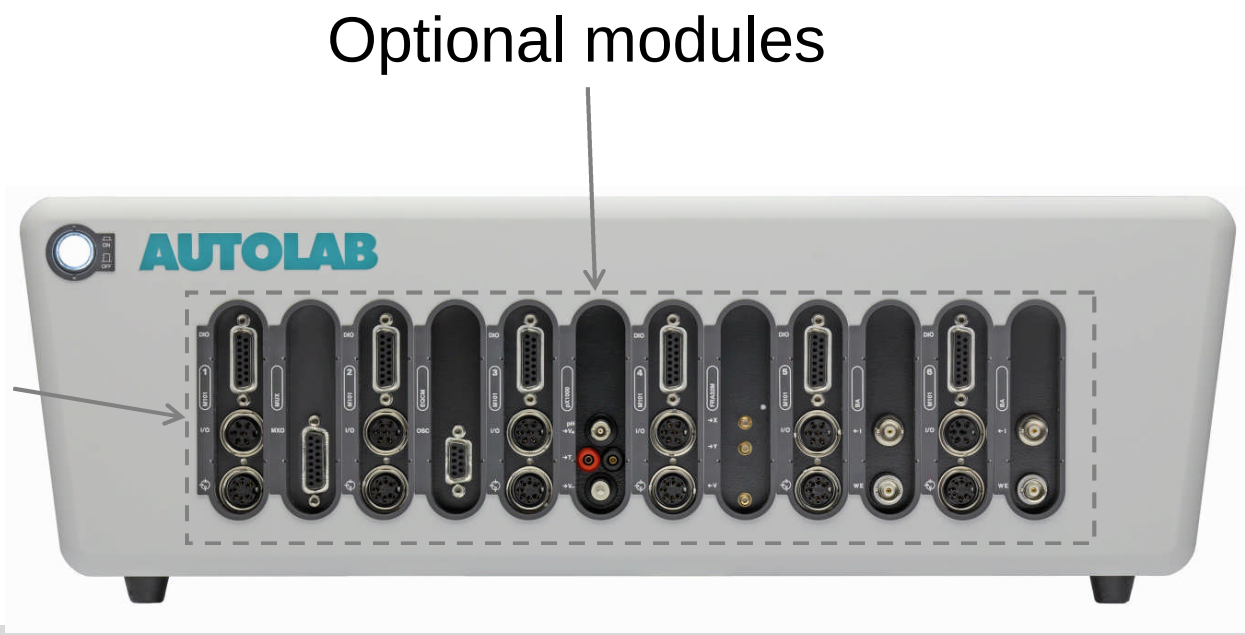
- Single channel PGSTAT module
  - Output power: 10 V / 100 mA
  - Potential range: 10 V
  - Current range: 10 nA to 10 mA in 7 decades
- Up to 12 modules can be installed

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Multi channel, modular

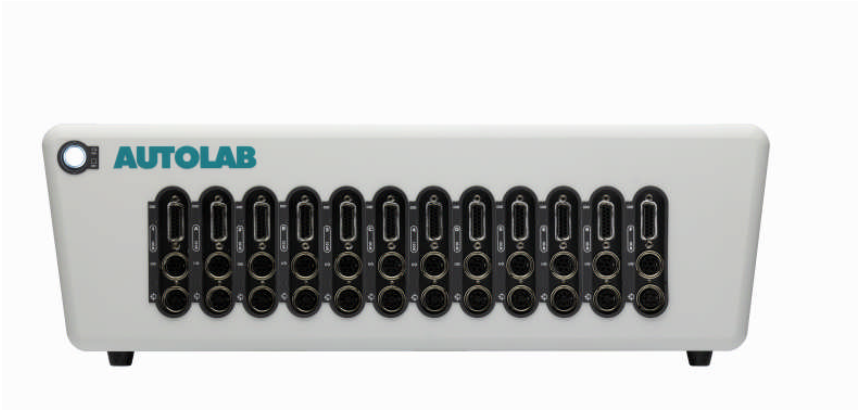
- Combination with optional modules



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Flexible System



PGSTAT only
12 M101 modules per frame



PGSTAT/Module combination
1-11 M101 modules per frame
1 optional module / M101

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Compatible Modules

- Optional modules can be installed alongside each M101 PGSTAT module
  - pX1000
  - MUX
  - FRA32M
  - BA
  - EQCM

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Unique Features

- Built-in hub allows control from 3 different computers
- Synchronization between channels possible

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Single Channel, Compact

Conveniently Priced, High Quality Instruments

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Compact design

- Potentiostat/Galvanostat with USB
- Compact design at entry level price



PGSTAT101
10 V / 100 mA



PGSTAT204
20 V / 400 mA

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New product!
PGSTAT204



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PGSTAT101 vs PGSTAT204

	PGSTAT101	PGSTAT204
Compliance voltage	10 V	20 V
Potential range	10 V	10 V
Maximum current	100 mA	400 mA
Modularity	No	Yes
Impedance option	No	Yes

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Special Applications

Customized Instrumentation

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PGSTAT302F

- Switchable floating mode instrument
- Suitable for working on grounded cells or setups requiring floating instrument
- Can be fitted with impedance spectroscopy module

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PGSTAT302F



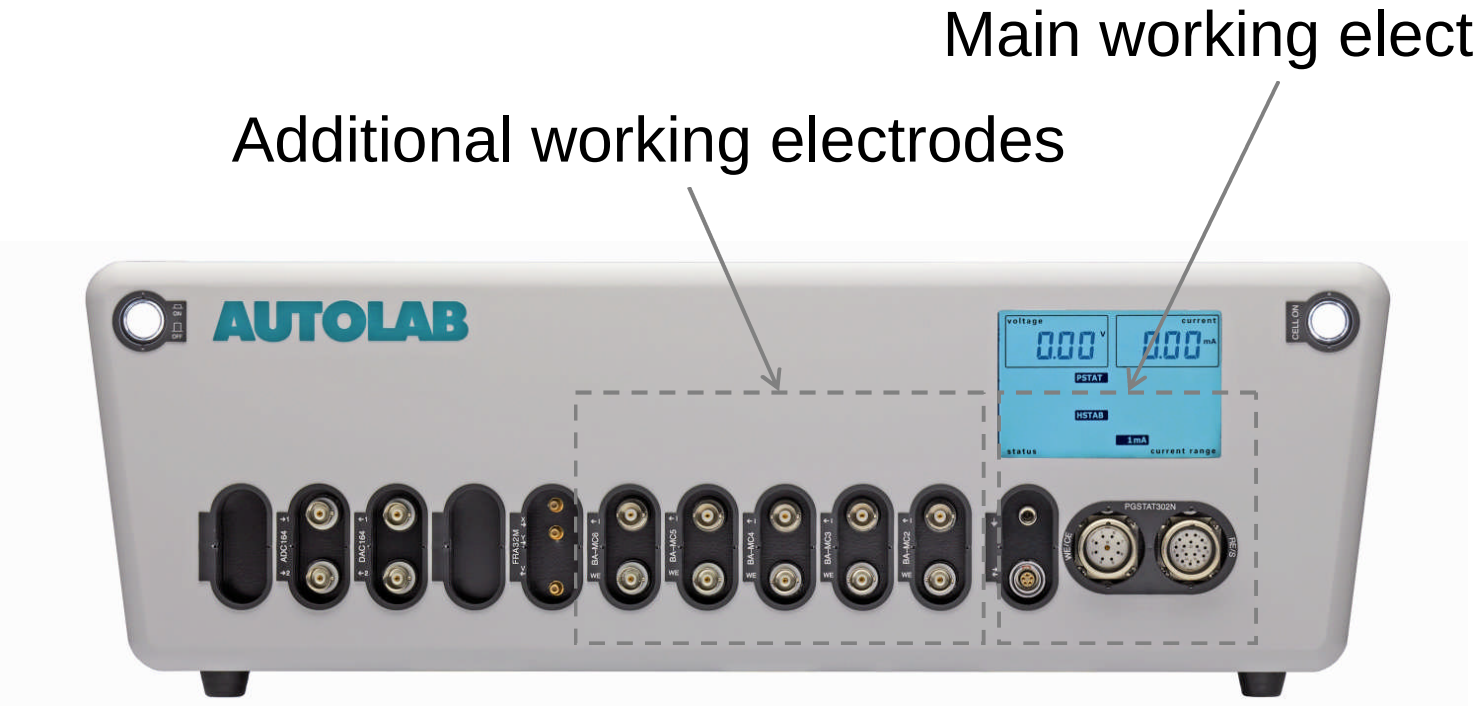
- Entry level modular PGSTAT
  - Output power: 30 V / 2 A
  - Potential range: 10 V
  - Current range: 10 nA to 1 A in 9 decades
  - Switchable from grounded to floating

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MultiBA Systems

- Multi working electrode system



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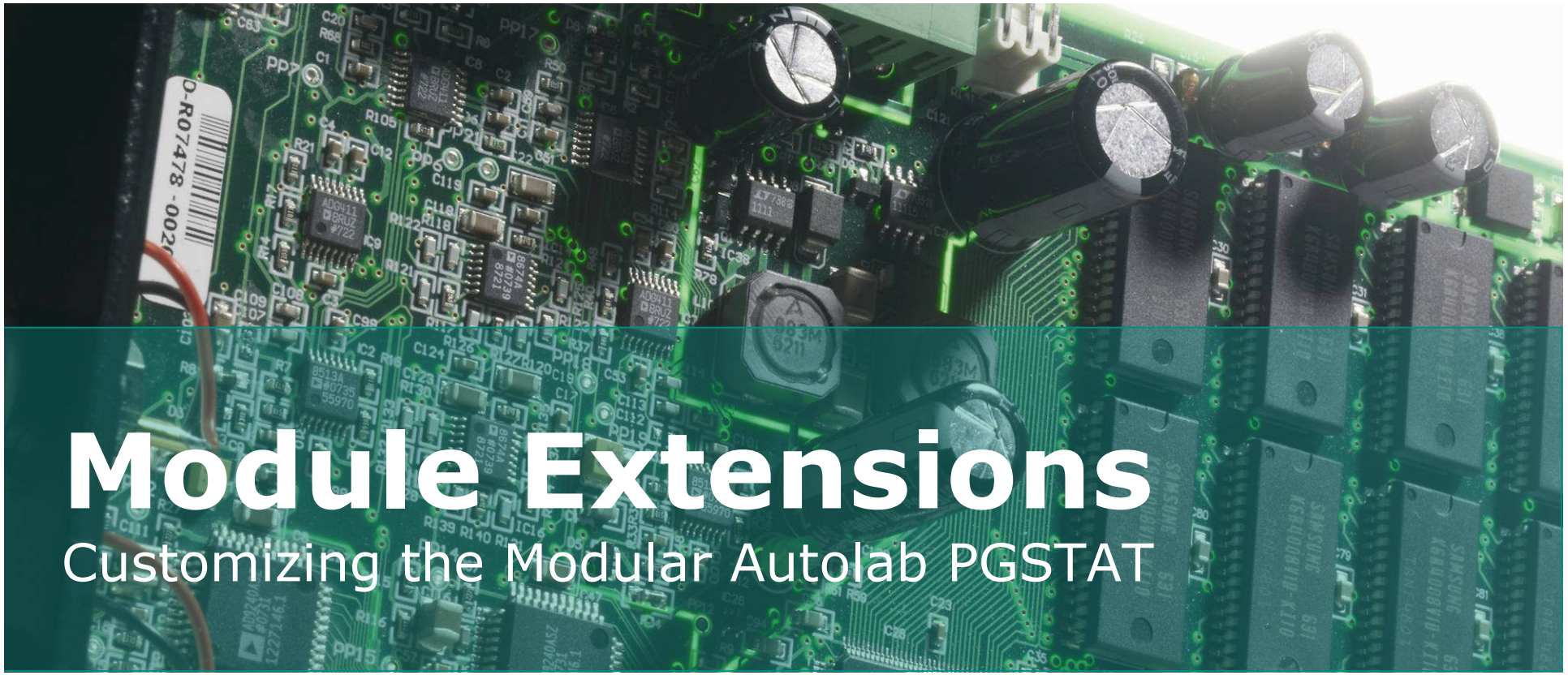
MultiBA Systems



- Multi working electrode system
- Shares the same Reference and same Counter electrode with up to 6 working electrodes
- Independent control on all electrodes

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Module Extensions

Customizing the Modular Autolab PGSTAT

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Modules

- Extension cards for the modular PGSTATs
- Can be added at any time
- Reverse compatible
- Can be installed onsite

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Modules

Module	Description	Main particularities
FRA32M	Electrochemical Impedance Spectroscopy	10 μHz-32 MHz*, single sine and multi sine, fit and simulation
SCAN250	True Analog Scan and Fast Scan	250 kV/s, analog scan generator
ADC10M	Fast Data Aquisition	10 MHz data acquisition card for very fast measurements
BA, MultiBA	Bi-Potentiostat	Bipot and Array, up to 6 WE
ECD	Low Current Amplifier	300 aA current resolution, RC filter included

* *1 MHz when used with a PGstat*

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Metrohm Autolab B.V.

Modules

Module	Description	Main particularities
pX1000	pH, pX, Voltage and T	Additional diffamp for voltage measurements
EQCM	Electrochemical Quartz Crystal Microbalance	6 MHz, < $\mu g/cm^2$ possible
FI20	Yes	Real time Filter & Integrator
MUX	Multiplexer	Up to 64 cells or 255 WEs
ECN	Electrochemical Noise	800 nV voltage resolution
Booster10A, 20A	Current Boosters	Apply and measure up to 20A

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Impedance Modules

- Frequency Response Analysis module (FRA) for impedance spectroscopy
  - FRA32M (2011)
  - FRA2 (→ 2011)

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Impedance Modules

- Frequency Response Analysis module (FRA) for impedance spectroscopy
  - FRA32M (2011)
  - FRA2 (→ 2011)

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FRA32M Module

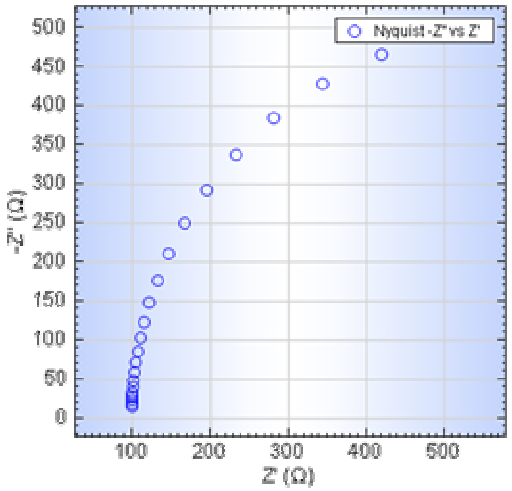
- Module for electrochemical impedance spectroscopy
  - 32 MHz to 10 µHz
  - 1 MHz to 10 µHz in combination with the PGSTAT
  - DC range: up to 10 V
  - Single sine and multi-sine

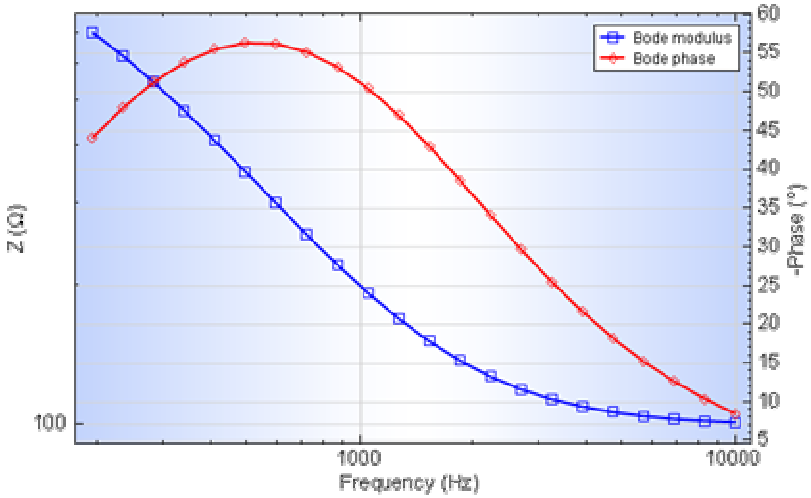
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FRA32M/FRA2 Module

- Electrochemical impedance spectroscopy



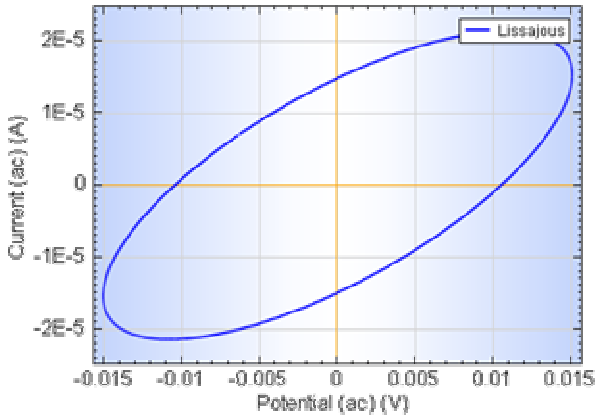


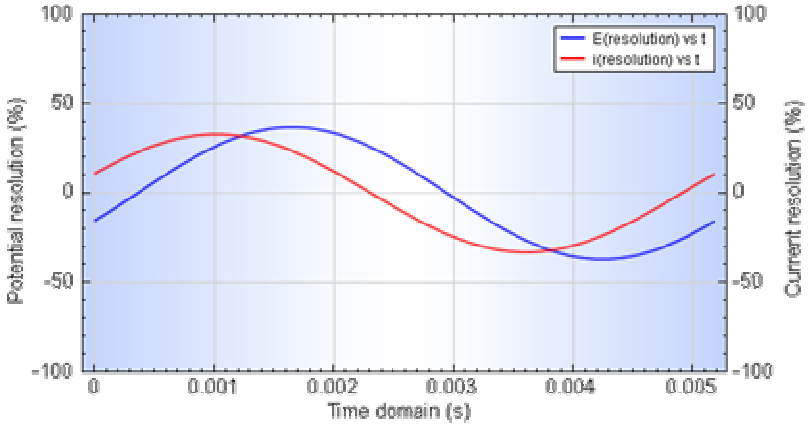
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FRA32M/FRA2 Module

- Electrochemical impedance spectroscopy



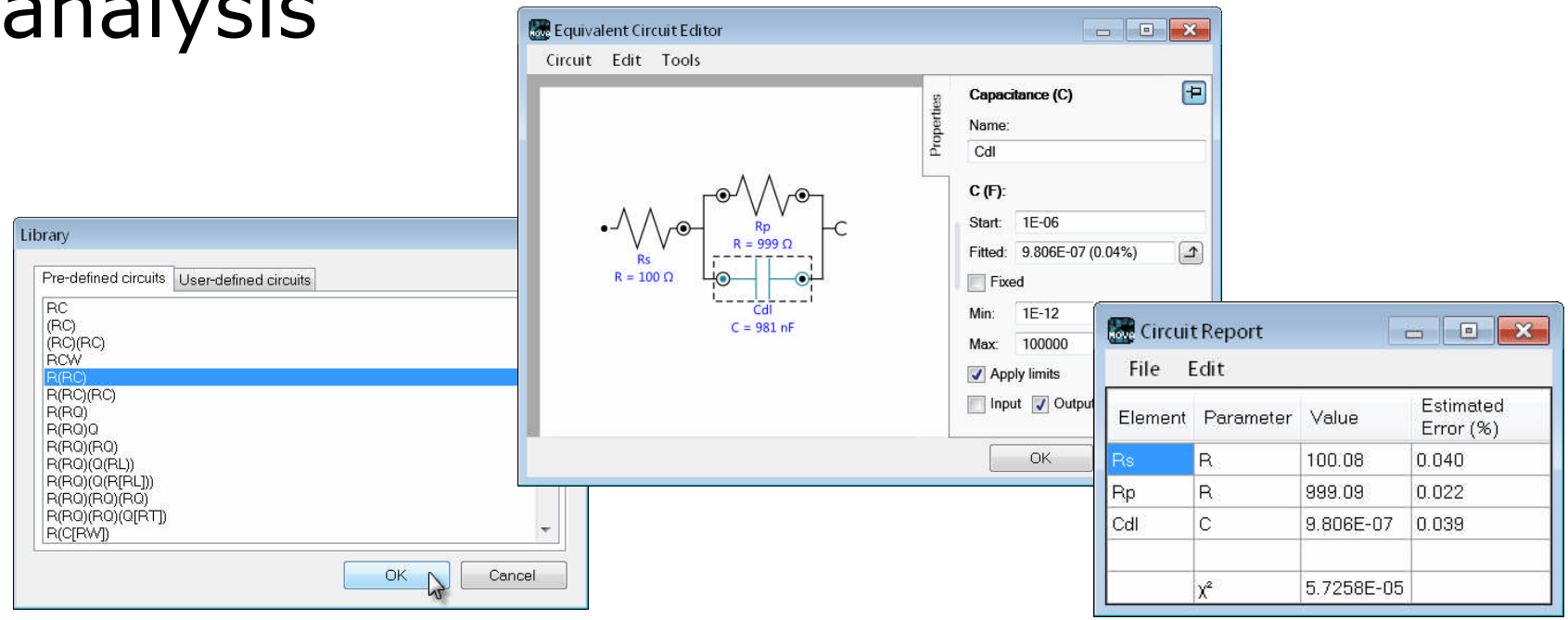


Advanced plots for raw measured data

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FRA32M / FRA2 Module

- Software integrates powerful data analysis



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FRA32M/FRA2

- Module compatibility

	FRA32M	FRA2
PGSTAT128N	Yes	Yes
PGSTAT302N	Yes	Yes
PGSTAT100N	Yes	Yes
PGSTAT101	No	No
M101	Yes	No
PGSTAT204	Yes	No
PGSTAT302F	Yes	Yes
MultiBA	Yes	Yes

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SCAN250 Module

- True analog scan generator module
  - Scan rate: 10 mV/s to 250 kV/s
  - Scan range: ± 5 V vs DC offset
  - Linear scan (no staircase)

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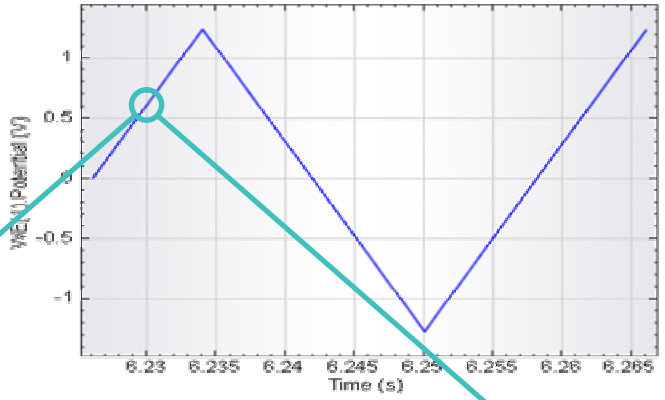
SCAN250 Module

- Critical difference between staircase and linear scan
- Significant reduction in currents with staircase methods
- Can lead to the wrong conclusions

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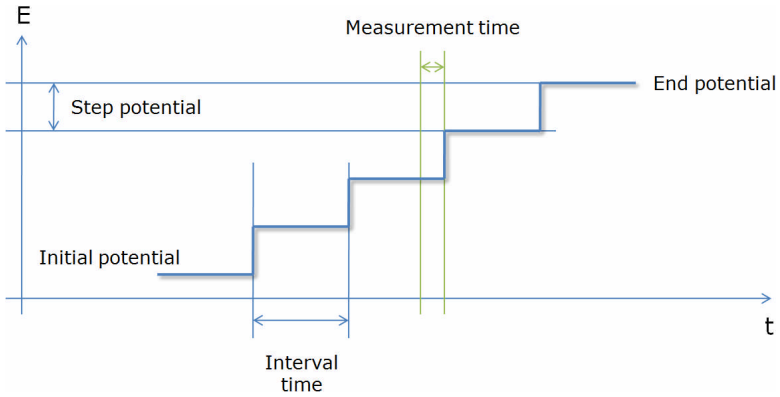
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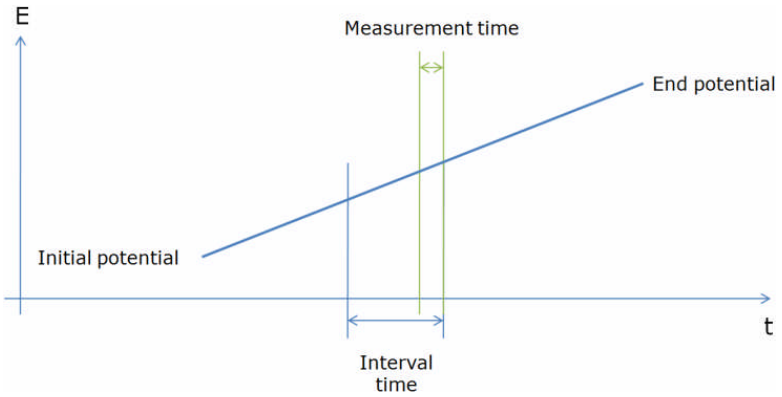
SCAN250 Module



staircase

linear



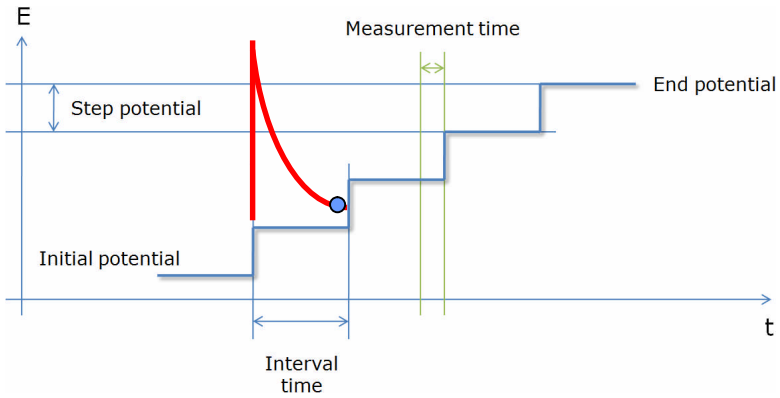


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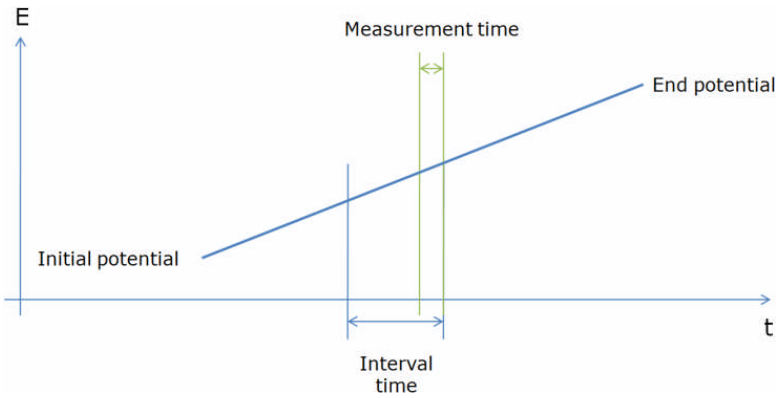
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SCAN250 Module

staircase



linear



Step: $\frac{\partial V}{\partial t} \rightarrow \infty$

Current spike: $i_c = C_{dl} \frac{\partial V}{\partial t}$

Plateau: $\frac{\partial V}{\partial t} = 0$

Current decay: $i = \frac{E_{step}}{R_u} e^{-\frac{t}{R_u C_{dl}}}$

Ramp: $\frac{\partial V}{\partial t} = const \neq 0$

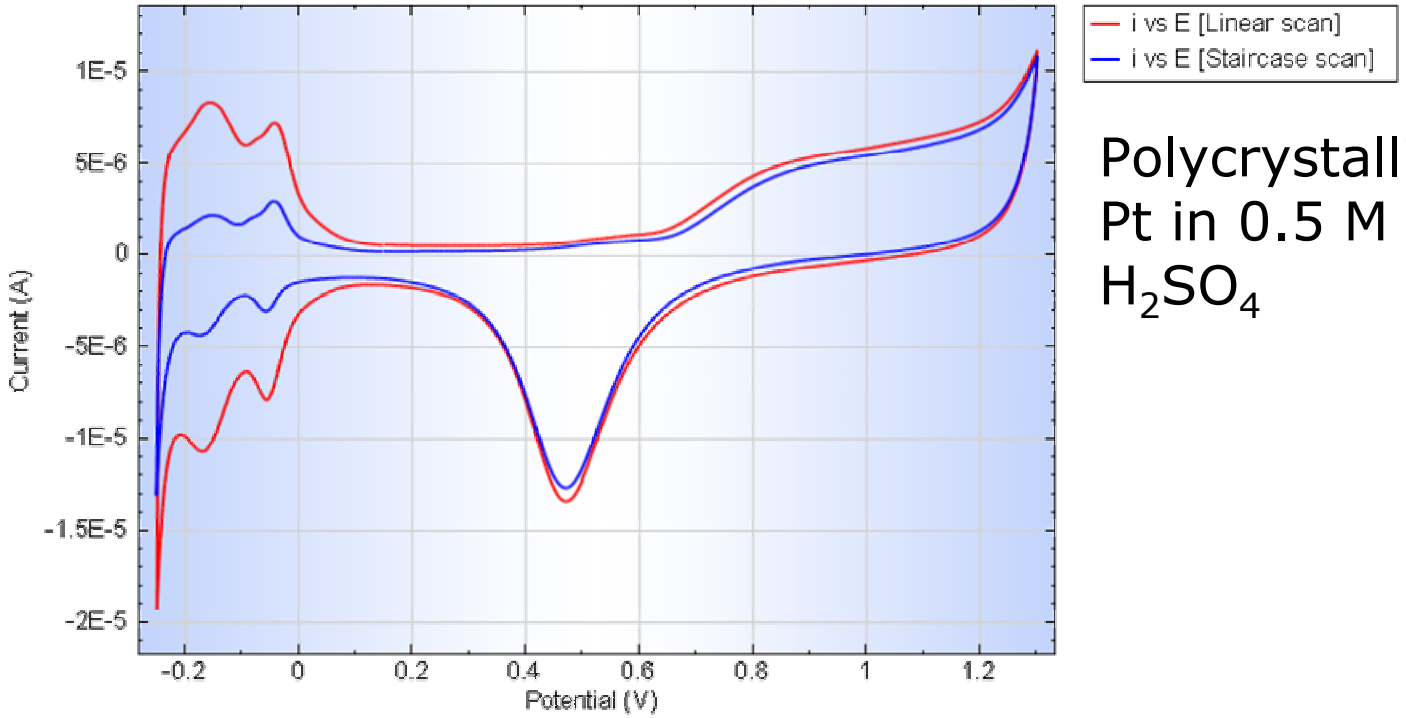
Const charging current: $i_c = C_{dl} \frac{\partial V}{\partial t}$

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SCAN250 Module

- Linear scan vs Staircase



Polycrystalline Pt in 0.5 M H_2SO_4

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SCAN250 Module

- Module compatibility

	SCAN250
PGSTAT128N	Yes
PGSTAT302N	Yes
PGSTAT100N	Yes
PGSTAT101	No
M101	No
PGSTAT204	No
PGSTAT302F	No
MultiBA	No

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ADC10M Module

- Ultra fast sampling synchronous A/D converter
- Sampling rate: 10 M samples/s
- Lowest interval time: 100 ns

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ADC10M Module

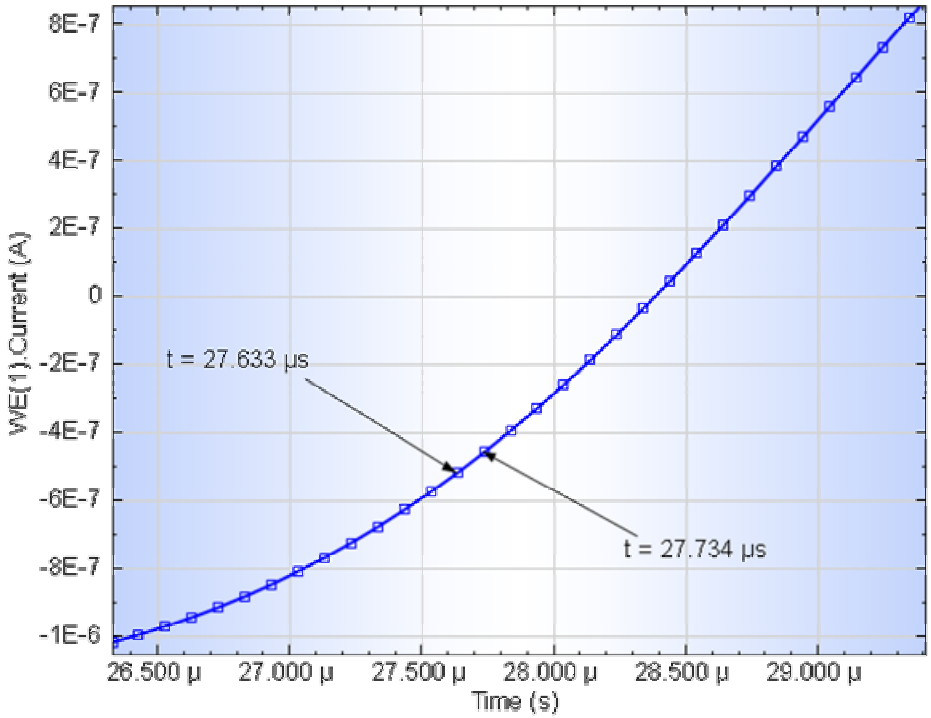
- Sampling rate: 10 M samples/s
- Lowest interval time: 100 ns
- Maximum scan rate in combination with SCAN250: 250 kV/s
- Maximum number of points: 1 M

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ADC10M Module

- 100 ns interval time



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ADC10M Module

- Module compatibility

	ADC10M
PGSTAT128N	Yes
PGSTAT302N	Yes
PGSTAT100N	Yes
PGSTAT101	No
M101	No
PGSTAT204	No
PGSTAT302F	No
MultiBA	No

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BA Module

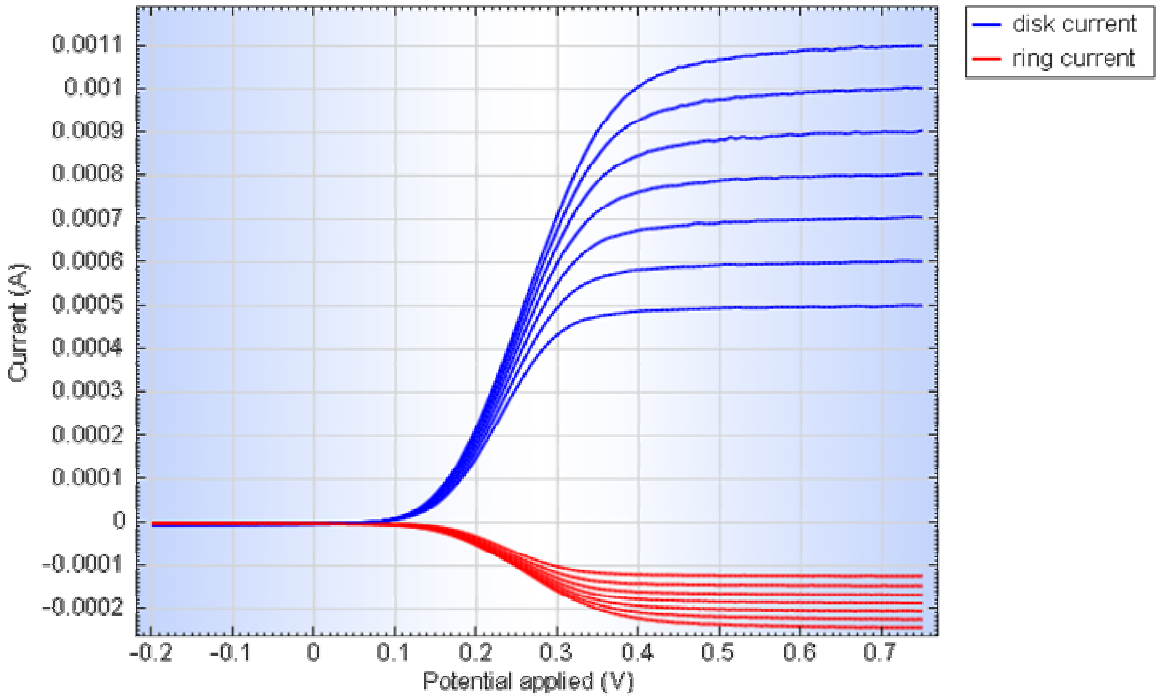
- Dual mode Bipotentiostat module
  - Bipot (vs RE) or Scanning Bipot (vs WE)
  - Potential range: 10 V
  - Maximum current: 50 mA
  - Current ranges: 10 nA to 10 mA in 7 decades

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BA module

- Measurements on 2 working electrodes



RRDE
Rotating Ring Disc Electrode measurements

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BA Module

- Module compatibility

	BA
PGSTAT128N	Yes
PGSTAT302N	Yes
PGSTAT100N	Yes
PGSTAT101	No
M101	Yes
PGSTAT204	Yes
PGSTAT302F	No
Multi BA	Yes (max. 5)

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ECD Module

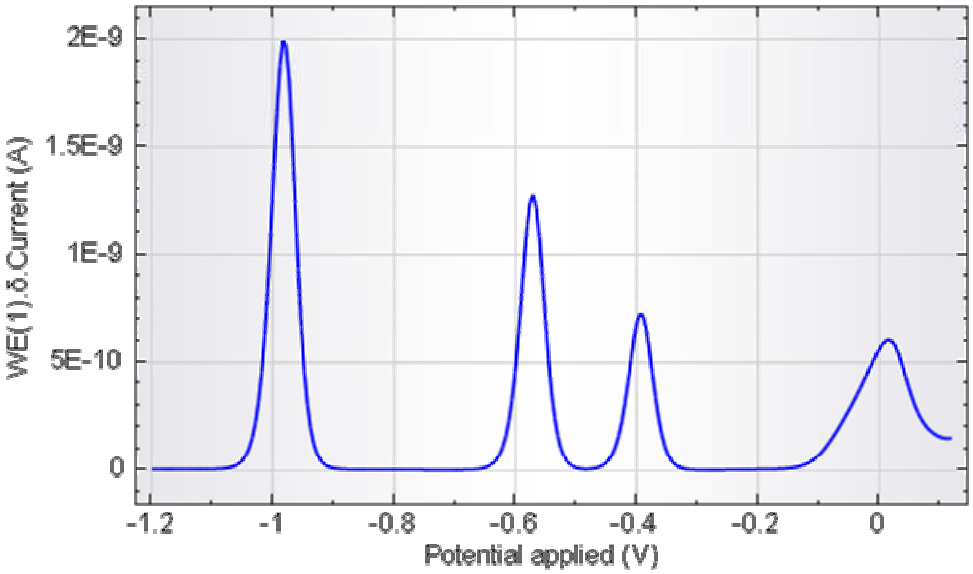
- Low current amplifier module
- Current ranges: 100 µA to 100 pA in 7 decades
- Integrated 3rd order Sallen-Key filter (0.1 s, 1 s & 5 s)
- Resolution: 0.003 % of current range
- Maximum resolution: 300 aA

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ECD Module

- Built-in offset compensation for low current measurements



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ECD Module

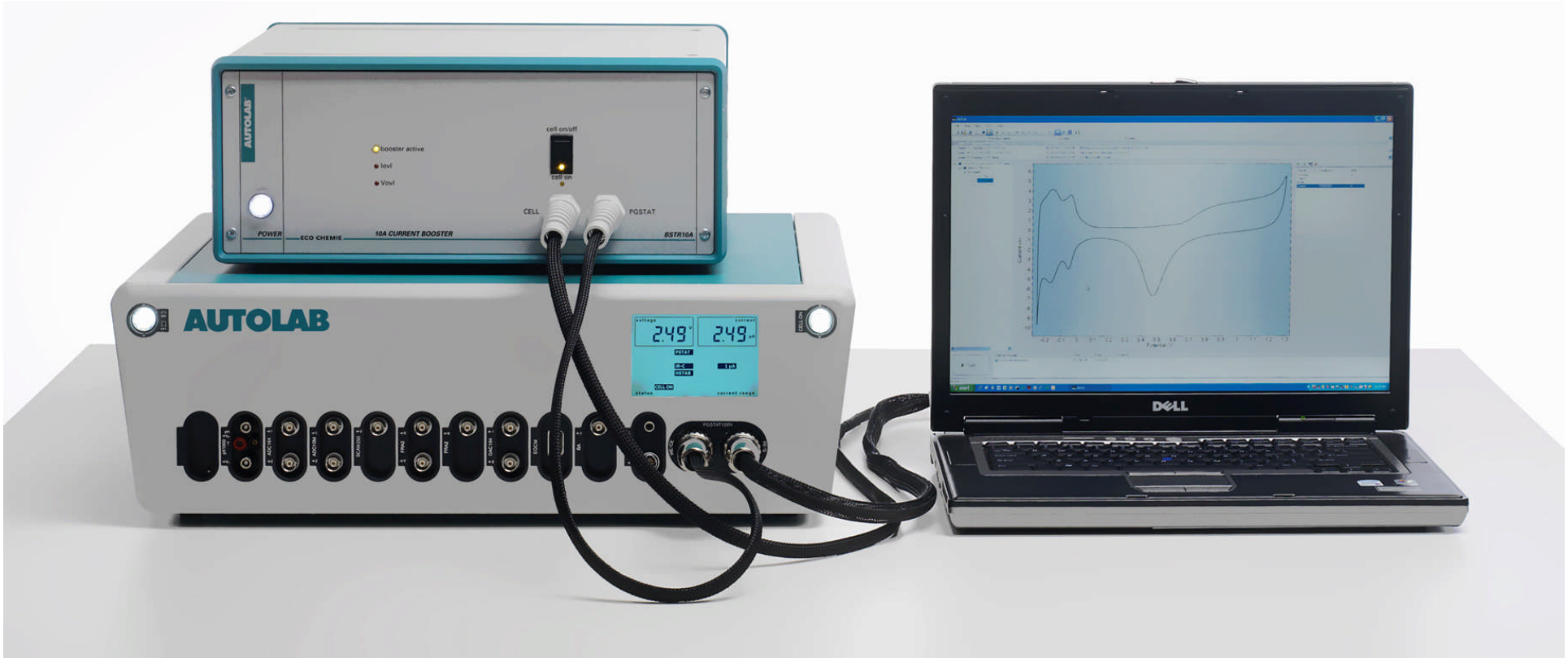
- Module compatibility

	ECD
PGSTAT128N	Yes
PGSTAT302N	Yes
PGSTAT100N	Yes
PGSTAT101	No
M101	No
PGSTAT204	No
PGSTAT302F	No
MultiBA	No

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Booster10A/20A



External high current amplifiers

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Booster10A/20A

- High current amplifier
  - 20 A maximum current (Booster20A)
  - 10 A maximum current (Booster10A)

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Booster10A/20A

	Booster10A	Booster20A
Compliance voltage	20 V	20 V
Maximum voltage	10 V	10 V
Maximum current	10 A	20 A
Bandwidth	10 kHz	20 kHz
Compatibility	PGSTAT128N/302N/100N	PGSTAT302N

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pX1000 Module

- pH and T measurements
- Input range: 10 V
- Potential resolution: 30 µV
- Temperature resolution: 0.1°C

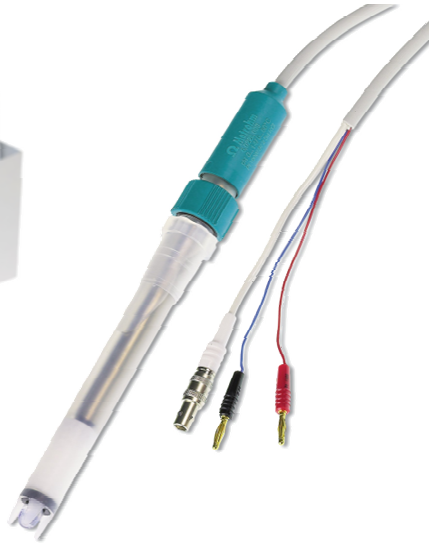
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pX1000 Module

- pH sensor connection
- Automatic pH correction with temperature
- Built-in calibration application





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pX1000 Module

- Module compatibility

	pX1000
PGSTAT128N	Yes
PGSTAT302N	Yes
PGSTAT100N	No
PGSTAT101	No
M101	Yes
PGSTAT204	Yes
PGSTAT302F	No
MultiBA	No

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ECN module

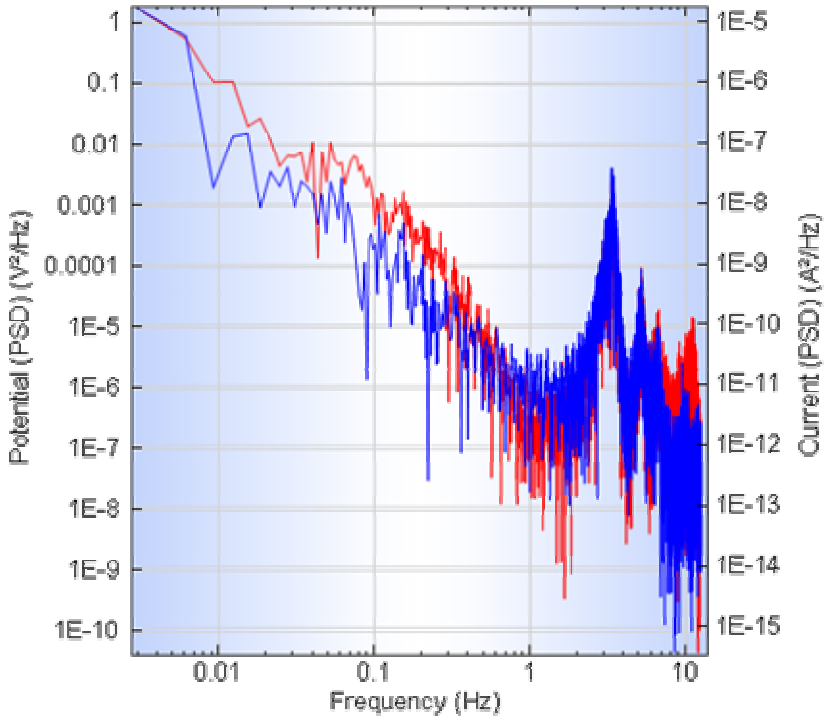
- Electrochemical noise and galvanic coupling
  - Input range: 2.5 V
  - Maximum resolution: 760 nV
  - DC offset compensation circuit

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ECN module

- Current and potential noise measurements



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ECN Module

- Module compatibility

	ECN
PGSTAT128N	Yes
PGSTAT302N	Yes
PGSTAT100N	No
PGSTAT101	No
M101	No
PGSTAT204	No
PGSTAT302F	No
MultiBA	No

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FI20 module

- Analog filter and integrator
  - Integrated 3rd order Sallen-Key filter: 0.1 s, 1 s & 5 s)
  - Available integration time constants: 0.01 s, 0.1 s, 1 s & 10 s

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FI20 Module

- Module compatibility

	FI20 - Filter	FI20 - Integrator
PGSTAT128N	Yes	Yes
PGSTAT302N	Yes	Yes
PGSTAT100N	Yes	Yes
PGSTAT101	No	Built-in
M101	No	Built-in
PGSTAT204	No	Built-in
PGSTAT302F	No	No
MultiBA	No	No

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MUX module

- Multiplexer device for single or multiple electrodes
  - **MUX-MULTI4:** monitor up to **64** electrochemical cells in sequence
  - **MUX-SCANNER16:** monitor up to **255** working electrodes in the same cell in sequence

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MUX Module



Sequential measurements on independent electrochemical cells or on several working electrode

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MUX Module

- Module compatibility

	MUX
PGSTAT128N	Yes
PGSTAT302N	Yes
PGSTAT100N	No
PGSTAT101	No
M101	Yes
PGSTAT204	Yes
PGSTAT302F	No
MultiBA	No

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EQCM module

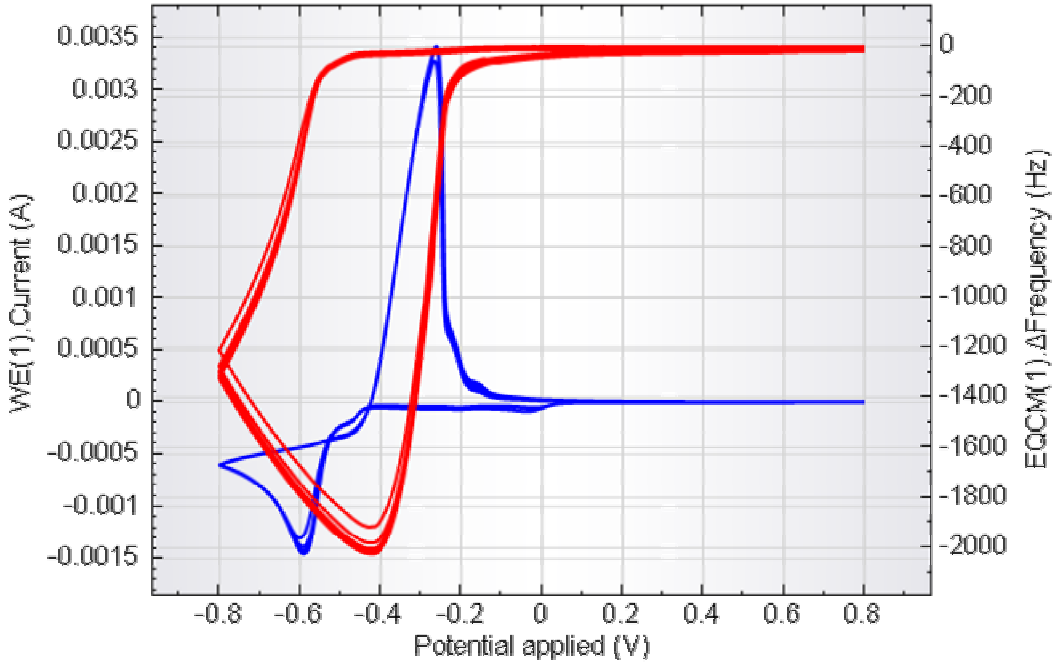
- Quartz crystal microbalance module
  - 6 MHz crystal oscillator
  - Dynamic range: 80 kHz
  - Integrated temperature sensor
  - Detection limit: < 10 ng/cm^2

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EQCM module

- Electrogravimetric measurements



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EQCM Module

- Module compatibility

	EQCM
PGSTAT128N	Yes
PGSTAT302N	Yes
PGSTAT100N	No
PGSTAT101	No
M101	Yes
PGSTAT204	Yes
PGSTAT302F	No
MultiBA	No

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Software

Advanced NOVA Electrochemical Software

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Software Overview

- Two software packages available:
  - NOVA – Advanced electrochemical software
  - SDK – Software Development Kit

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Autolab NOVA

- One application for any electrochemical experiment
- New software for the Autolab Potentiostat/Galvanostat with USB
- From simple to advanced experiments
- Real time data handling for dynamic procedures

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Autolab SDK

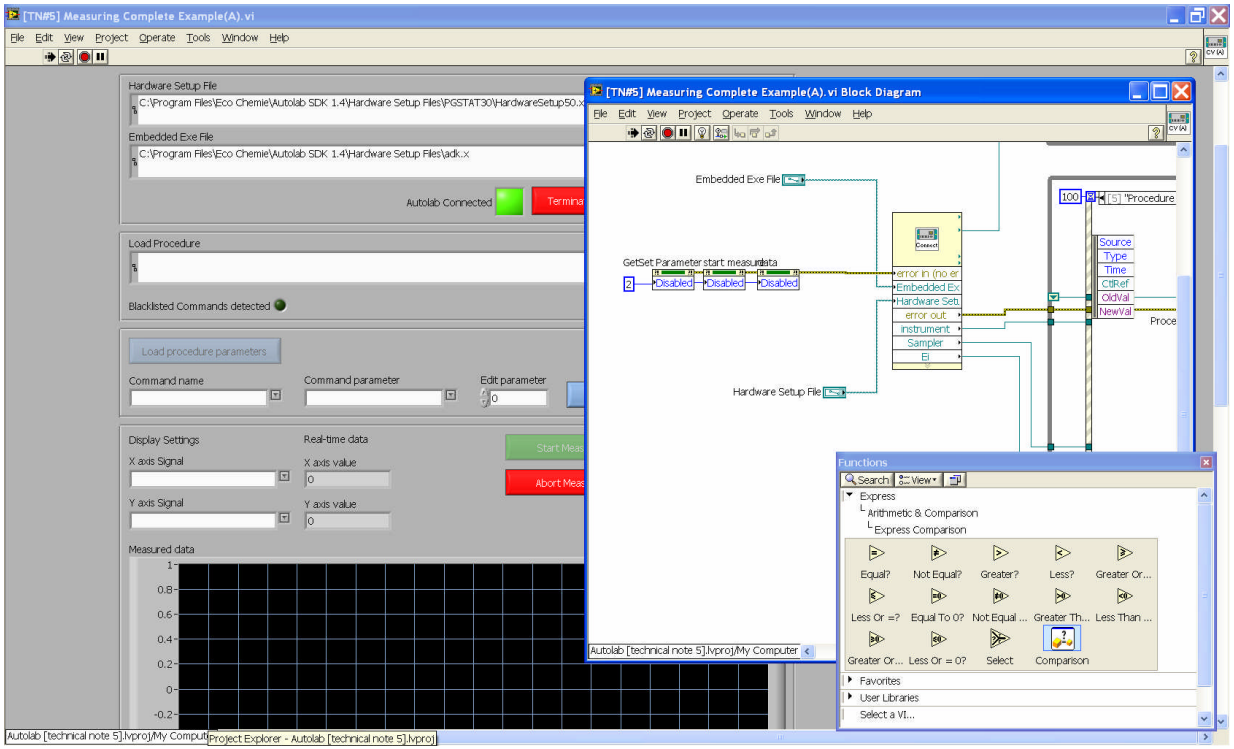
- Software Development Kit
- Provides controls for the Autolab instruments through 3rd party application like LabVIEW, Mathlab, …

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Autolab SDK

Library of LabVIEW VIs provided with the SDK



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Accessories

A Complete Range of Electrochemical Accessories

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Rotating Disc Electrode (RDE)

- Supplied with external motor controller



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Rotating Disc Electrode

- Mercury contact for friction-less measurements
- 0 – 10000 RPM (manual or software)
- 4000 RPM/s acceleration
- Compatible with 3 and 5 mm electrode tips

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Autolab Optical Bench



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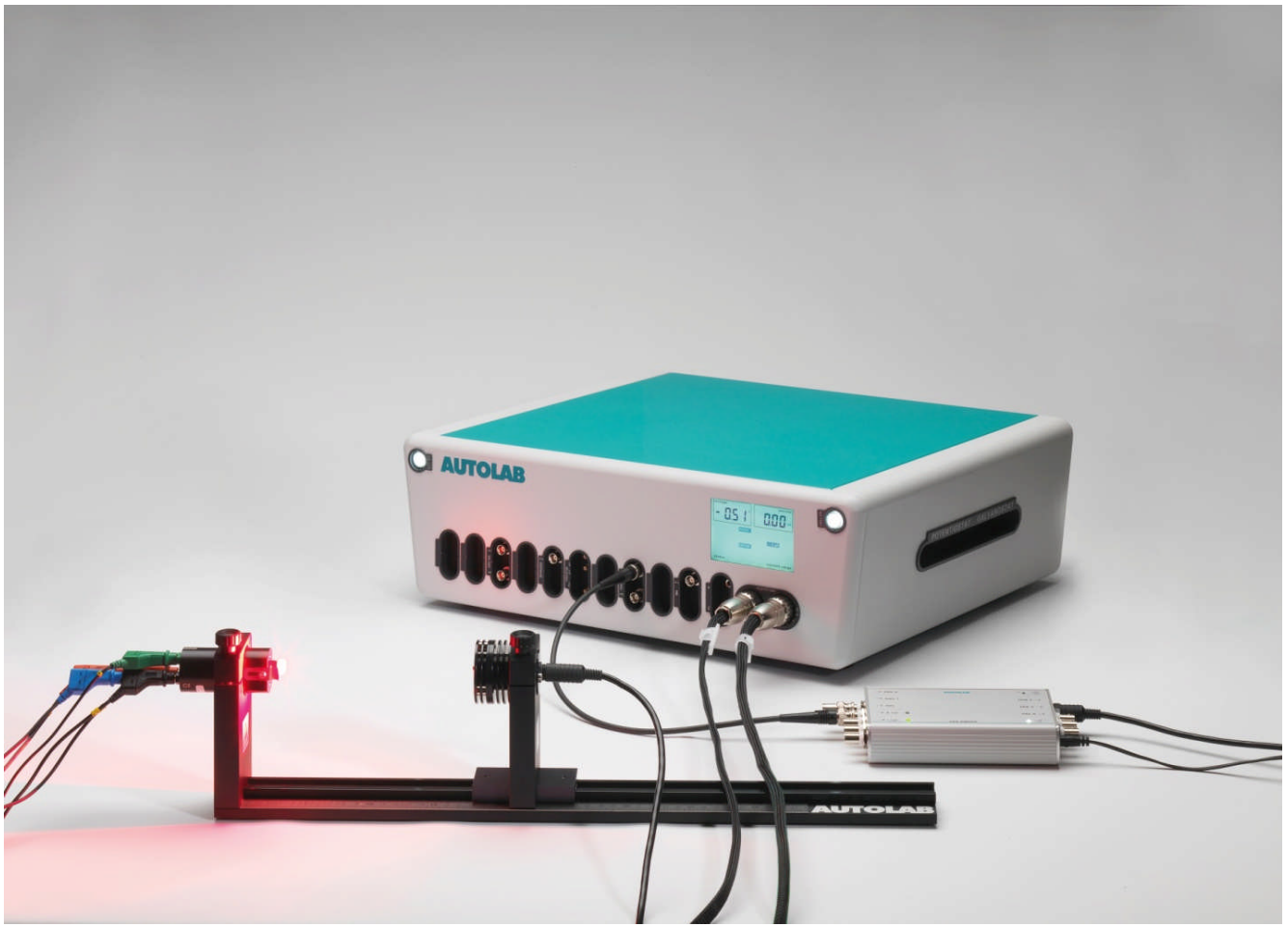
Autolab Optical Bench

- For studying the optical behaviour of photovoltaic cells
- Software integrated control of light intensity
- Up to 10 interchangeble LEDs

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Autolab Optical Bench



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Autolab Optical Bench

Article code	Color	Wavelength (nm)
AUT.LED.LDC655	Deep-Red	655
AUT.LED.LDC627	Red	627
AUT.LED.LDC617	Red-Orange	617
AUT.LED.LDC590	Amber	590
AUT.LED.LDC530	Green	530
AUT.LED.LDC505	Cyan	505
AUT.LED.LDC470	Blue	470
AUT.LED.LDC	Cool white	-
AUT.LED.LDC	Warm white	-
AUT.LED.LDC	Neutral white	-

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Voltammetric analysis stand



Hg drop electrode stand (663 VA Stand) and IME663 interface

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Voltammetric analysis stand

- Remote control through the IME663 interface
- Stirrer, purging and new drop control
- DME, SDME, HDME control
- Voltammetric analysis methods

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Multi Mode Electrode

- Hg drop
  - DME
  - SMDE
  - HDME



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Electrochemical Cells

- General purpose cells and stands



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Corrosion Cells

- Dedicated cells for corrosion measurements
  - 1 L cell
  - 400 mL cell
  - Flat cell

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Corrosion Cell (1 L)

- ASTM compliant
- 1 cm^2 sample holder
- 6 conical fittings
- Luggin capillary



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Corrosion Cell (400 mL)

- 5 conical fitting
- Sample area 0.785 cm^2
- Luggin capillary
- Thermostatic jacket



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Flat Cell

- Corrosion cell for large surface areas
- Surface area > 15 cm^2

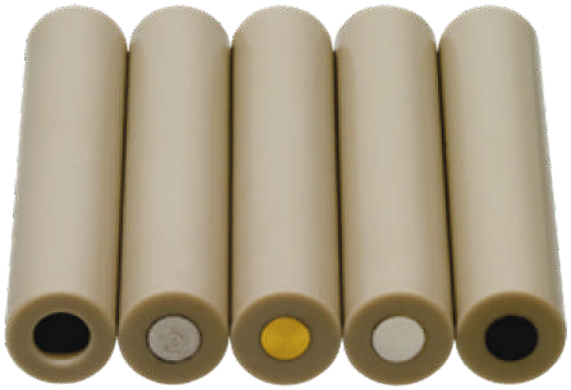


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Working Electrodes

- 3 mm and 5 mm electrode tips
- Au, Pt, GC, Ag
- Empty tip for custom material



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Microelectrodes

- Different µm range diameters available

Material	Diameter (µm)
Platinum	10, 20, 25, 50, 100, 200, 300, 500
Gold	10, 25, 40, 100, 200, 300, 500
Palladium	25, 60, 100, 200, 300, 500
Silver	25, 30, 60, 100, 200, 300, 500
Iridium	75



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Reference Electrodes

- Different reference electrodes available
- Single and double junction



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Counter Electrodes

- Range of materials available
- Pt, GC, Stainless steel

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Faraday cage

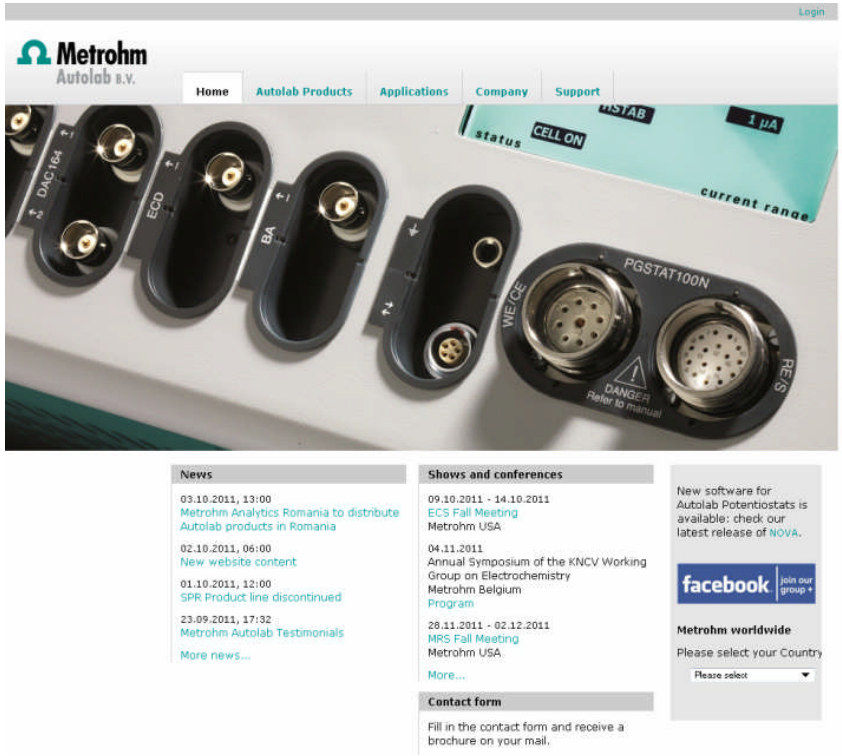
- Provides shielding for the electrochemical cell
- Compatible with Metrohm cell stands

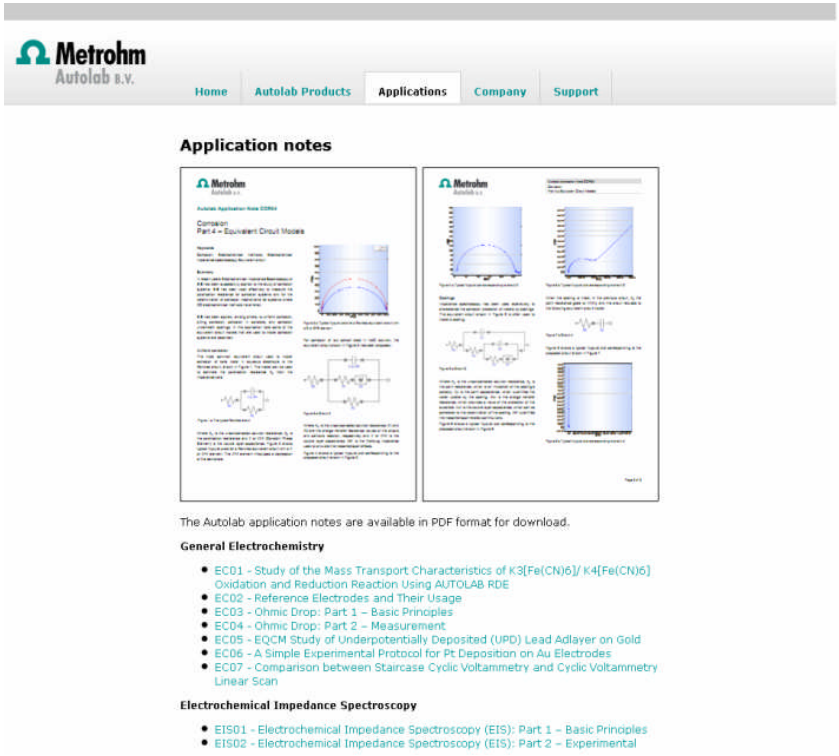


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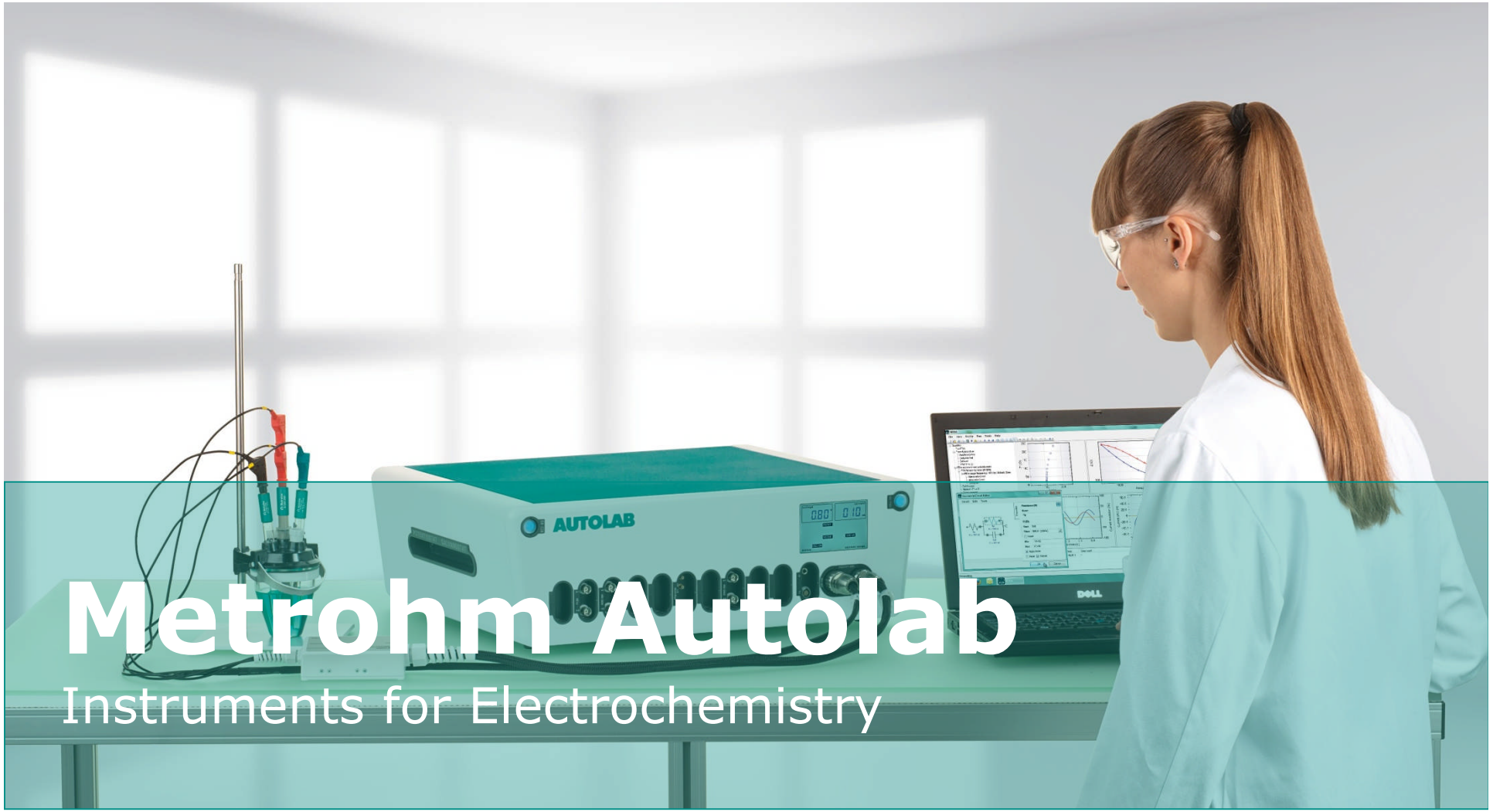
Service and Support

- All instruments covered by 3 years factory warranty



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Instruments for Electrochemistry

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