Instruments for electrochemical research

Metrohm
Autolab

Dedicated to research

Metrohm Autolab sets the standard for electrochemistry instrumentation. Over 30 years ago, we created the first commercially available digital potentiostat/galvanostat that was completely computer controlled. Today our NOVA software is the most powerful electrochemistry software on the market.

Metrohm Autolab creates instruments that are suitable for most application areas including: corrosion, energy, environmental, sensors, and solar. Our customers may not always be electrochemists, but they are engaged in fundamental and applied research harnessing the power of electrochemistry for further understanding. They are driven to understand and improve electrochemical processes with the ambition to deliver new materials with superior properties and future possibilities.

With an Autolab potentiostat/galvanostat and NOVA software there are no limits to where your research can go.

Reliability

- Metrohm Autolab's **integrated testing process** ensures that each component is **traceable and tested individually** after installation in the instrument.
- Metrohm Autolab instruments undergo up to **405 quality checks** during the manufacturing process.
- Our installed instruments average **99%** uptime in the first **5 years of installation**.*

Versatility

- **Metrohm Autolab** instruments are the **workhorses** of **electrochemical research** delivering the **requirements of most application areas** with our range of **instruments, modules and accessories.**
- **Modular instruments** allow you to **change and expand** the **functionality** of your instrument.
- **Specialist modules can be installed** to provide additional electrochemical measurements and possibilities as your research progresses.

Superior Service

- Metrohm Autolab provides an **industry-leading 3 year warranty** for all its instruments, modules and instrument accessories.
- Our **dedicated distribution** and **service network** provide a **fast response** for sales and service, usually within **48 hours.**
- Our colleagues are **people you can trust** to understand your requirements and **provide solutions** to **support your research objectives**.

Powerful software

- NOVA is the **powerful data acquisition** and **analysis software** that powers your experiment.
- **Essential procedures** and **multiple analysis options** are built-in with the ability to **modify** and **create** your own.
- NOVA helps **maximize your laboratory throughput** with useful features that put the **focus** on **safety** and **production**.

3 year
instrument warranty

Metrohm Autolab is a member of the Metrohm Group, manufacturers of high-precision instruments for chemical analysis.

*Based on European markets most widely sold instrumentation.

Versatile instruments for electrochemical research

Metrohm Autolab instruments

Modular instruments

The Modular instrument family provides limitless possibilities for your electrochemical research when combined with our **versatile range of modules**.

Instrument options:
PGSTAT128N, PGSTAT302N

Multichannel instruments

For laboratories that require **multiple workstations** for **parallel measurements** or replication, with the versatility of a modular instrument, **the Multichannel instrument family** meets your needs. You can customize the 12 instrument channels for your unique experimental requirements by mixing and matching potentiostat/galvanostats and modules (a maximum of 6).

Instrument options:
MultiAutolab M101, M204

Compact instruments

If space is at a premium in your laboratory, or you are establishing your electrochemistry workstation, our range of **compact instruments** will get you started. While small in size the PGSTAT204 allows you to add one module for maximum versatility.

Instrument options:
PGSTAT101, PGSTAT204

Metrohm Autolab develops and manufactures Potentionstat/Galvanostat instruments.

Instrument Accessories

In addition to the instruments and modules that create a tailored workstation for your research, Autolab also offer a range of **high-quality instrument accessories**. You can be assured that all accessories meet Autolab's rigorous standards for **reliability** and are included in our warranty guarantee.

Examples include:

- Autolab Microcell HC
- Corrosion cells
- Electronic load interfaces
- Faraday cage
- Optical bench
- VA Stand
- Rotating disk electrode (RDE)
- Rotating ring disk electrode (RRDE)
- UV/VIS Spectrophotometers

PGSTAT302N with ADC10M, SCAN250, FRA32M, and ECI10M modules.

Find

Metrohm Autolab's range of specialist application notes - check out our Application Finder. www.metrohm.com/applications

Create your own tailored workstation

Metrohm Autolab Modules

Electrochemical impedance spectroscopy module (FRA32M)	With the **FRA32M module** you can use **EIS** to **quantify all elements** of your electrochemical system. The module gives you a **wide frequency range** (10 µHz to 1 MHz) and with the NOVA software you can have complete data analysis (fit and simulation) available **within a click**. The module also **maximizes the resolution** of measurements with the **Automatic Amplitude Correction** algorithm (AAC) providing **accurate impedance measurements**.
High frequency impedance spectroscopy (ECI10M)	The **ECI10M** is ideal for **solid state electrochemistry** with **expanded measureable range** for **EIS** to a maximum of 10 MHz and **ultra-fast reaction mechanism** for greater insight into the electrochemical interface. With a **small form** factor it is suitable for your lab bench, Faraday cage or glovebox.
True analog scan generator module (SCAN 250)	A **true analog scan generator module** is exactly what it sounds like - up to **250kV/s**† allows you to **measure fast reaction rates, reaction kinetics, reversibility** of **electrochemical processes**.
Dual-channel ultra-fast sampling module (ADC10M)	The **Autolab ADC10M** captures **ultra-fast surface reactions** by **increasing the sample rate down to a 100 ns** interval for **2 signals.**
Dual-mode bipotentiostat module (BA)	With the **Autolab Dual-mode bipotentiostat module (BA)** you can design experiments that use **2 independently controlled working electrodes** in the same electrochemical cell. Using either **fixed potential** or the **scanning mode** you can expand your **exploration** in a convienient setup.
Booster 10A/20A	Give your **current** a **boost** with the **Autolab Booster** expanding your application options including **electrochemical impedance (EIS)** measurements when used with a **FRA32M**. The **fast response** time coupled with **four quadrant operation*** will give you detailed data that you can analyze for **greater insight** in to your experiment.

PGSTAT204 with 10A Booster module

† in combination with the ADC10M

* 10A: x: ± 10 Volt y: ± 10 Amp; 20A: x: ± 10 Volt y: ± 20 Amp.

Easily adapt even after installation

Metrohm Autolab Modules

Low current amplifier module (ECD)	**Increase data accuracy** by vastly decreasing the **minimum measurable current** of your experiment with the **Autolab ECD**. With a **built-in amplifier** you can **measure current peaks** down to a few **picoAmps** which opens new possibilities in sensor, corrosion and other research applications.
Electrochemical Quartz Crystal Microbalance Module (EQCM)	An **additional hyphenated** measurement is possible with the **Autolab EQCM** by recording the **change of the resonant frequency** of a quartz crystal oscillator and measuring the mass change per unit area.
Multiplexer module (MUX)	The **Autolab Muliplexer module** allows you to **increase throughput** with **automated sequential measurements** in the configuration of your choosing. Your setup can be comprised of **electrochemical cells, voltage measurements, or working electrodes**. There is a **manual option** for additional testing.
Analog filter and integrator module (FI20)	With **the Autolab FI20** the analog filter gives you the ability to **remove external noise** and **interference** from the measured signal. You can **smooth your data** using up to **3 different time constants** giving you more **accuracy** and **greater confidence** in your results. The **integrator** in the **Autolab FI20** combines time and current for conversion to Coulombs which you can **monitor** in **real-time** for **experiment versatility**.
Voltage and pH measurement module (pX1000)	The **pX1000** module provides **simultaneous and highly accurate pH, additional voltage** and **temperature measurements**. A **variety** of **experiment configurations** are possible with this module and you can even set your own **safety cutoffs** depending on your experiment requirements.
Electrochemical Noise Module (ECN)	The ultra-sensitive **Autolab ECN** allows in-depth understanding of **localized corrosion.** This is possible by measuring, in-situ, difficult to **detect stochastic electrochemical noise** as a function of time. NOVA provides **seamless analysis** of the measured noise at open circuit.

PGSTAT302N with ECI10M module

Instruments for a range of techniques and application areas

Module Compatibility

PGSTAT128N	PGSTAT302N	M101*	M204*	PGSTAT101*	PGSTAT204*	Module Type	Potential Application Segment
•	•					**Analog filter and integrator module** (FI20)	Electrocatalysis, Energy, Fundamental, Plating, Supercapacitors
•	•		•		•	**Booster 10A**	Batteries, Electrolysis, Energy, Fuel Cells, Supercapacitors
	•					**Booster 20A**	Batteries, Electrolysis, Energy, Fuel Cells, Supercapacitors
•	•					**Dual-channel ultra-fast sampling module** (ADC10M)	Electrocatalysis, Electroanalysis, Energy, Fuel Cells, Fundamental, Sensors, Supercapacitors
•	•	•	•		•	**Dual-mode bipotentiostat module** (BA)	Electrocatalysis, Electroanalysis, Energy, Fuel Cells, Fundamental, Sensors
•	•	•	•		•	**Electrochemical impedance spectroscopy module** (FRA32M)	Batteries, Corrosion, Electrocatalysis, Education, Energy, Fundamental, Plating, Sensors, Solar, Solid State, Supercapacitors
•	•					**Electrochemical noise module** (ECN)^	Corrosion
•	•	•	•		•	**Electrochemical Quartz Crystal Microbalance module** (EQCM)	Corrosion, Electroanalysis, Fundamental, Plating, Sensors
•	•					**High frequency impedance spectroscopy** (ECI10M)	Fundamental, Solar, Solid State
•	•					**Low current amplifier module** (ECD)	Corrosion, Electroanalysis, Fundamental, Sensors, Solid State, Trace analysis
•	•	•	•		•	**Multiplexer module** (MUX)	Batteries, Corrosion, Electrocatalysis, Electroanalysis, Energy, Fuel cells, Plating, Supercapacitors
•	•					**True linear scan generator module** (SCAN 250)	Electrocatalysis, Electroanalysis, Energy, Fuel Cells, Fundamental, Sensors, Solid State, Supercapacitors
•	•	•	•		•	**Voltage and pH measurement module** (pX1000) †	Corrosion, Electrocatalysis, Education, Electroanalysis, Fuel Cells, Fundamental, Plating, Sensors, Solid State, Trace analysis

M204 with MUX, EQCM, pX1000, FRA32M, BA modules.

Demo?

Your Metrohm Autolab distributor can show you our instruments and help you build the right workstation for your research requirements. **www.metrohm.com/how-to-find-us**

* Current integrator included.
† ECN and pX1000 installed together will incur an additional cost.

Capture, explore, and understand your data with NOVA

Powerful Data Acquisition and Analysis Software

Effortless Intuitive Software

- Users are comfortable with NOVA's **modern user interface** and **straightforward navigation.**
- NOVA has approximately **60 essential electrochemistry procedures** available for **preliminary exploration.**
- **NOVA Procedure Editor** enables you to design unique experimental procedures to create the research you imagined - without restrictions.

Intelligently Manage Your Laboratory

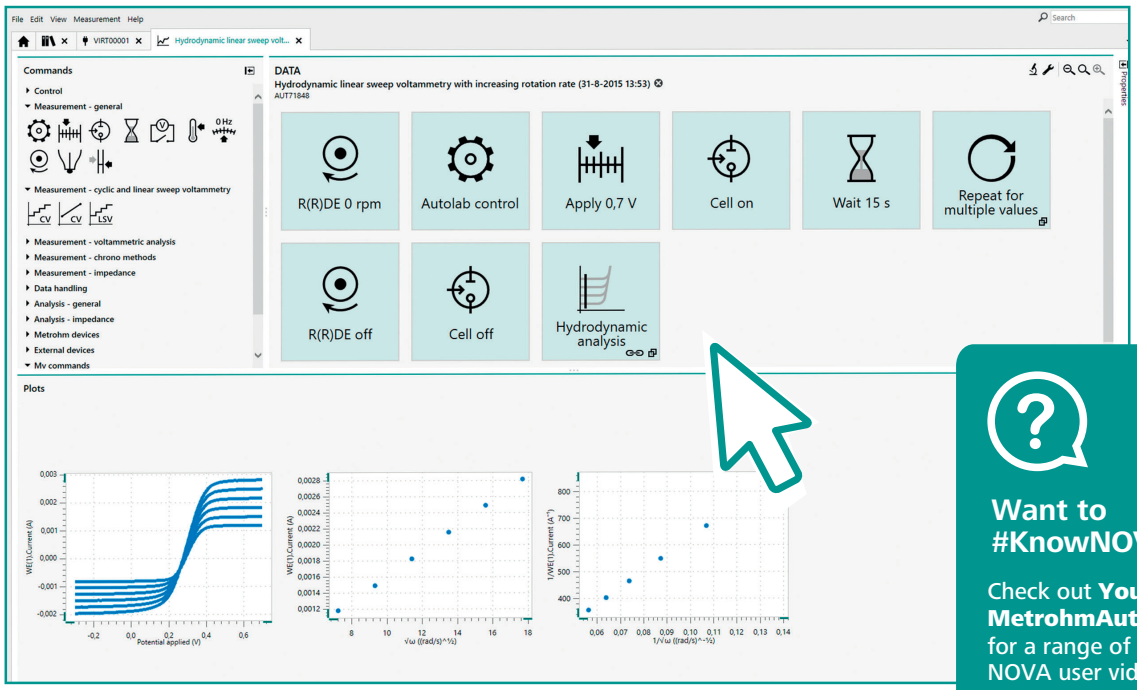
- **Maximize your instrumentation** with **NOVA Scheduler** to execute a series of procedures on multiple instruments.
- Conveniently **pre-configure** calculations for other lab users and the desired result will be available at the end of the measurement.

Efficiently Handle Your Experiment and Data

- You can work **flexibly** and **intervene** in your experiment; your actions will be **recorded automatically**.
- Once your analysis is optimized, **NOVA Data to Procedure** will automate your measurements including data handling.
- **Simultaneous** mathematical calculations on **signals** or **data** can be logged while the procedure is running.

Additional Features Unique to NOVA

- **NOVA's Virtual Instrument** feature allows you to validate your procedures before you go to another lab or facility.
- **NOVA Validation** checks if your experimental procedure will work with your instrument, before you spend time on an experiment.



Want to #KnowNOVA?

Check out **YouTube/ MetrohmAutolab** for a range of helpful NOVA user videos.

Technical Specifications

Instruments	PGSTAT101/M101	PGSTAT204/M204	PGSTAT128N	PGSTAT302N
• Modular	no / yes	one / yes	yes	yes
• Maximum current	± 100 mA	± 400 mA	± 800 mA	± 2 A
• Compliance voltage	± 10 V	± 20 V	± 12 V	± 30 V
• Applied potential accuracy	± 0.2% ± 2 mV	± 0.2% ± 2 mV	± 0.2% ± 2 mV	± 0.2% ± 2 mV
• Applied potential resolution	150 µV	150 µV	150 µV	150 µV
• Minimum measured potential resolution	3 µV (gain 100)	3 µV (gain 100)	0.3 µV (gain 1000)	0.3 µV (gain 1000)
• Maximum scan rate	1000 V/s with	1000 V/s with	1000 V/s with	1000 V/s with
• Current ranges	10 nA to 10 mA (in 7 ranges)	10nA to 100 mA (in 8 ranges)	10 nA to 1 A (in 9 ranges)	10 nA to 1 A (in 9 ranges)
• Current accuracy	± 0.2% ± 0.2% of current range	± 0.2% ± 0.2% of current range	± 0.2% ± 0.2% of current range	± 0.2% ± 0.2% of current range
• Applied current resolution	0.015% of current range	0.015% of current range	0.015% of current range	0.015% of current range
• Measured current resolution	0.0003% of current range	0.0003% of current range	0.0003% of current range	0.0003% of current range
- at 10 nA range	30 fA	30 fA	30 fA	30 fA
• Potentiostat bandwidth	> 1 MHz	> 1 MHz	500 kHz	> 1 MHz
• Potentiostat rise/fall time	< 300 ns	< 300 ns	< 500 ns	< 250 ns
• Input impedance of electrometer	> 100 GOhm // 8 pF	> 100 GOhm // 8 pF	> 1 TOhm // 8 pF	> 1 TOhm // 8 pF
• Input bias current @ 25 °C	< 1 pA	< 1 pA	< 1 pA	< 1 pA
• Bandwidth of electrometer	> 4 MHz	> 4 MHz	> 4 MHz	> 4 MHz
• iR-compensation	current interrupt and positive feedback	current interrupt and positive feedback	current interrupt and positive feedback	current interrupt and positive feedback
- resolution	0.025%	0.025%	0.025%	0.025%
• Electrode connections	2, 3 or 4	2, 3 or 4	2, 3, or 4	2, 3 or 4
• Front panel display	-	-	potential and current	potential and current
• Analog outputs (BNC)	potential and current	potential and current	potential and current	potential and current
• External voltage input	-	-	yes	yes
• Analog integrator	yes	yes	(optional)	(optional)
- time constants	0.01 s, 0.1 s, 1 s, and 10 s	0.01 s, 0.1 s, 1 s, and 10 s	0.01 s, 0.1 s, 1 s, and 10 s	0.01 s, 0.1 s, 1 s, and 10 s
• Interfacing	USB	USB	USB	USB
• A/D converter	16-bit with gains of 1, 10, and 100	16-bit with gains of 1, 10, and 100	16-bit with gains of 1, 10, 100, and 1000	16-bit with gains of 1, 10, 100, and 1000
• External input/output signals	1/1	1/1	2/2	2/2
• D/A converter	16-bit, 3 channels	16-bit, 3 channels	16-bit, 4 channels	16-bit, 4 channels
• Digital I/O lines	12	12	48	48
• Dimensions (W×D×H)	9×21×15 cm^3	15×26×20 cm^3	52×42×16 cm^3	52×42×16 cm^3
• Weight	2.1 kg	4.5 kg	16 kg	18 kg
• Power requirements	40 W	75 W	180 W	300 W

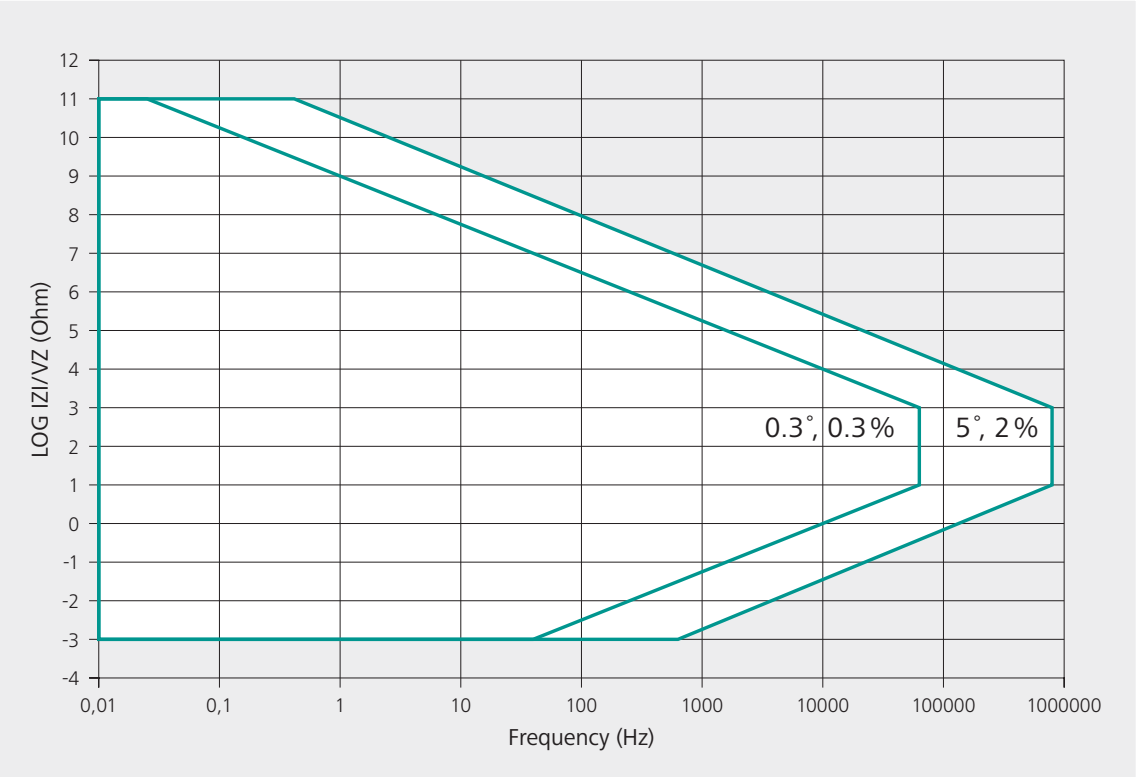
FRA32M

For accuracy of the FRA32M see the contour plot on the next page.
The frequency range of the FRA32M is 10 µHz –1 MHz.
Check out **www.metrohm.com/autolabspecs**
for additional specification information on all modules.

The PGSAT302N is available in a floating option with ± 30 V compliance voltage (grounded).

High Performance EIS

Contour Plot



This contour plot is an **accurate** and **precise** representation of the performance of a 302N with FRA32M module in potentiostatic mode.

- **Autolab's FRA32M** module offers a **wide range** of **measureable impedance** suitable for applications from low impedance batteries to high impedance coatings and everything in between.
- **Autolab** offers **phase change accuracy** at a **wide impedance range** as well as the ability to **modulate** other **outside signals**.
- **Initiate EIS** using the **NOVA software** for measurements and analysis including **fit and simulation**.
- This module can be **added** to most **Autolab instruments** at purchase or later installed on-site by our service specialist.

ECAT Workstation with PGSTAT302N with Rotating Ring Disk Electrode (RRDE).


Levich Plot

Frontcover image
PGSTAT204 with NOVA software displayed.
8.000.5314EN - 2019-07

Dedicated to research

www.metrohm.com/electrochemistry

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