REDEFINING HIGH VALUE ELECTROCHEMISTRY

INTERFACE1010

Potentiostat/Galvanostat/Zero Resistance Ammeter

GAMRY INSTRUMENTS

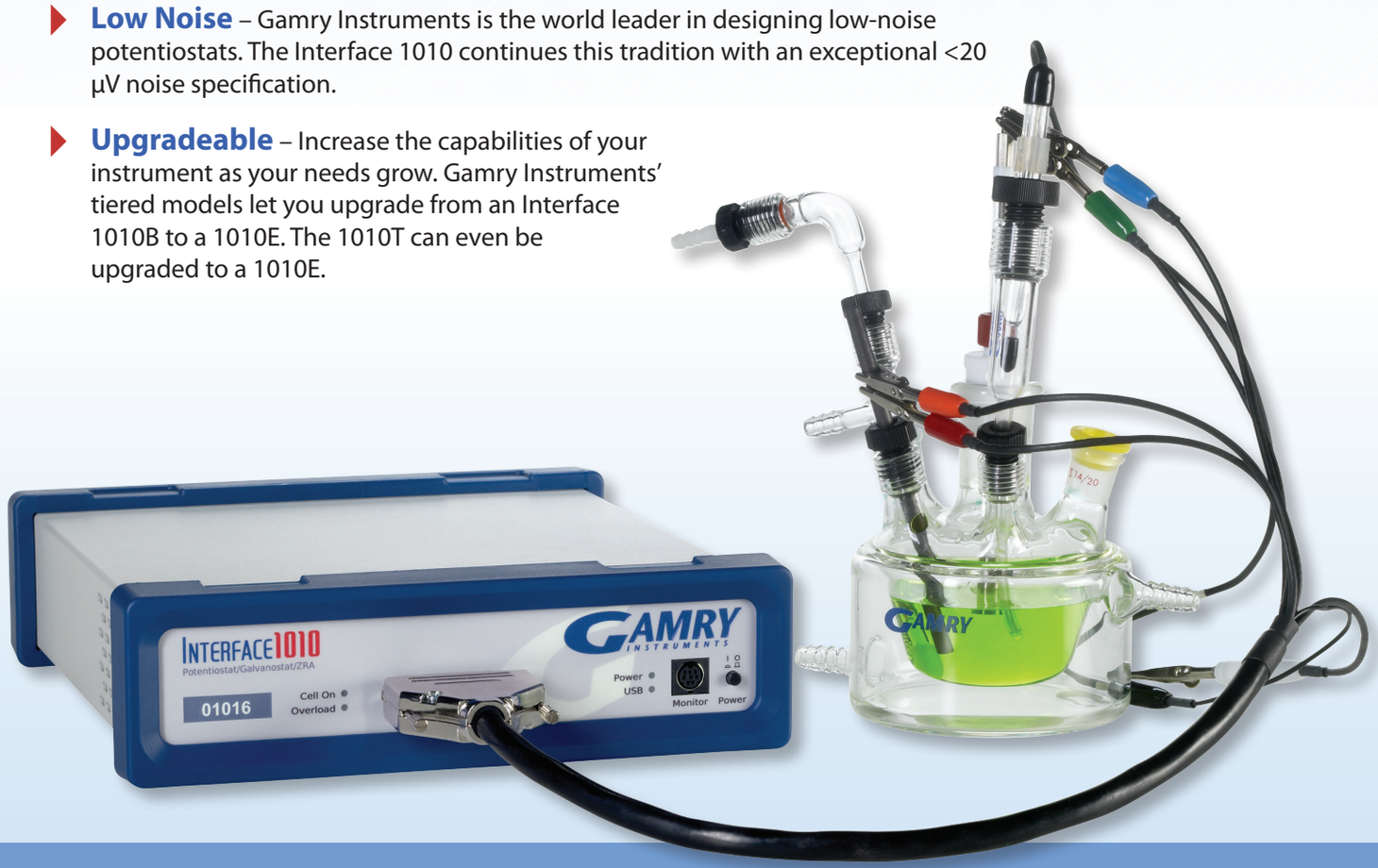
HIGHLIGHTS

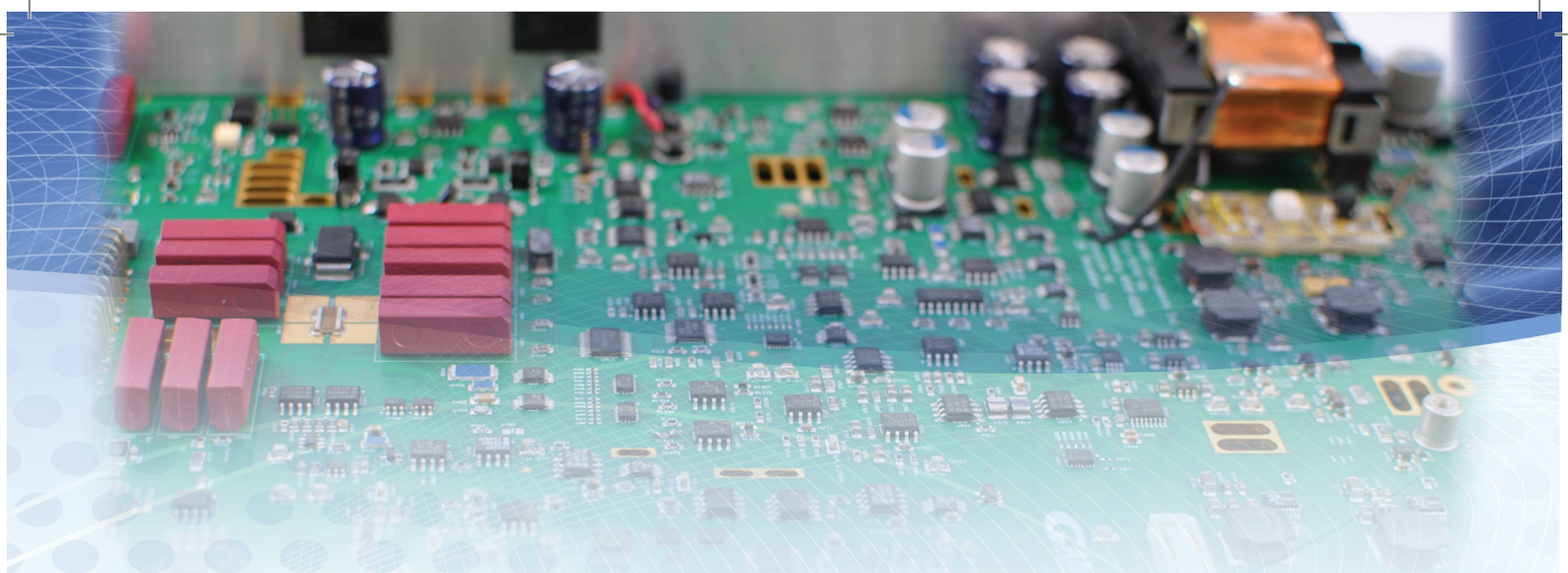
The Interface 1010™ potentiostat/galvanostat/ZRA is extremely popular, with an EIS range that extends to 2 MHz and integrated temperature monitoring. It is ideal for corrosion measurements, battery testing, sensor development, and physical electrochemistry. The Interface 1010™ is the perfect blend of performance and value.

Three models to suit your needs:

- **Interface 1010T** – A specially designed model for teaching labs that can do basic Physical and Analytical Electrochemistry, DC Corrosion, and Potentiostatic EIS to 20 kHz.
- **Interface 1010B** – The basic model is equipped with our Physical Electrochemistry, Pulse Voltammetry, DC Corrosion, and EIS to 20 kHz.
- **Interface 1010E** – This model includes everything available for running any type of electrochemical experiment.

- **Flexible and Powerful** – 9 current ranges from 1 A down to 10 nA.
- **Floating** – Designed from the ground up to provide true floating capability. Easily measure grounded electrodes, grounded cells, or multiple working electrodes in a shared electrolyte.
- **Easily Transported** – Weighing a mere 2 kg and carried as easily as a book, the Interface 1010 continues Gamry Instruments' tradition of pairing capability with portability.
- **Low Noise** – Gamry Instruments is the world leader in designing low-noise potentiostats. The Interface 1010 continues this tradition with an exceptional <20 µV noise specification.
- **Upgradeable** – Increase the capabilities of your instrument as your needs grow. Gamry Instruments' tiered models let you upgrade from an Interface 1010B to a 1010E. The 1010T can even be upgraded to a 1010E.





MULTICHANNEL WITHOUT LIMITS

- **Dedicated Performance** – Gamry Instruments' multichannel setup is designed to get you full capabilities out of each channel. No multiplexing of measurements unlike other manufacturers.
- **Isolation** – Each channel is isolated, letting you run on grounded cells or multiple working electrodes.
- **High Bandwidth** – Gamry Instruments' multichannel setup lets you place each channel closer to your cell, letting you use shorter cables. Shorter cables mean more bandwidth for your measurements.
- **Modular** – Gamry Instruments' multichannel setup allows you to remove channels for placement closer to your cell. You can even remove a channel to take into the field or when traveling to another lab.

ELECTROCHEMICAL APPLICATIONS

ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY—EIS

EIS is a powerful tool for a variety of applications. Gamry Instruments civilized EIS by combining sophisticated data acquisition with state-of-the-art hardware design. The Interface 1010 maintains these innovations by making EIS easy to use, compact, accurate, and affordable. Gamry Instruments' wide range of EIS techniques include potentiostatic, galvanostatic, hybrid, and Mott-Schottky. Our software also includes optimized, power-leveling multisine techniques for both potentiostatic and galvanostiatic EIS. We even include Total Harmonic Distortion to give you non-linear behavior of your sample!

CORROSION

Electrochemical corrosion testing is a mainstay of Gamry Instruments' potentiostats and the Interface 1010 is no exception. Gamry Instruments' impressive collection of corrosion-related experiments are all available to run on the Interface 1010. Along with EIS, we offer for corrosion researchers:

DC Corrosion Techniques – 14 experiments from basic to advanced cover most corrosion testing.

Electrochemical Noise – Different setups for different levels of sophistication, including the most powerful noise software available.

Electrochemical Frequency Modulation – A non-destructive multisine technique that returns beta constants and a corrosion rate. Causality factors are automatically calculated to confirm the validity of your data.

Critical Pitting Temperature – As per ASTM G150. Special hardware is required, but this provides information not available through other techniques.

PHYSICAL ELECTROCHEMISTRY

Gamry Instruments offers a complete library of physical and electroanalytical techniques for the Interface 1010. These include linear sweep and cyclic voltammetry, chronamperometry, chronocoulometry, chronopotentiometry, differential pulse, and square-wave voltammetry. Multiple-step or repeating techniques are available for chronoamperometry and chronopotentiometry.

BATTERIES, FUEL CELLS, SUPERCAPACITORS

Research on various electrochemical energy systems combines some tried-and-true electrochemical techniques like EIS and CV, but also brings unique challenges to the table. Gamry Instruments has several specially designed experimental techniques for the Interface 1010 that allow high-performance testing of electrochemical energy devices.

FILMS AND COATINGS

Materials and corrosion scientists frequently deal with thin films and coatings. EIS is a major part of the electrochemical testing of films and coatings. For some researchers DC corrosion tests may also be applicable while for others physical electrochemistry or energy device-type experiments are more appropriate. The Interface 1010 is compatible with all of these options, and the 4-probe setup allows for impedance testing of a membrane without compounding it with electron-transfer impedances.

MORE…

Gamry Instruments' software capabilities go beyond the set experiments above. A Virtual Front Panel™ and eChem Toolkits™ allow users with some specialty ideas to run different tests, design their own software to control the Interface 1010, or integrate their Gamry Instruments system into a setup with other devices.

Gamry Instruments can also provide custom solutions for non-standard experimental techniques that you may need. Call us to discuss your application.

PERFORMANCE

The Interface 1010™ is Gamry Instruments' high-performing value Potentiostat/ Galvanostat/ZRA. It is ideal for labs on a budget doing fundamental electrochemical studies. The performance/cost ratio makes it the best choice for multichannel setups where performance cannot be sacrificed for higher throughput.

Low Noise

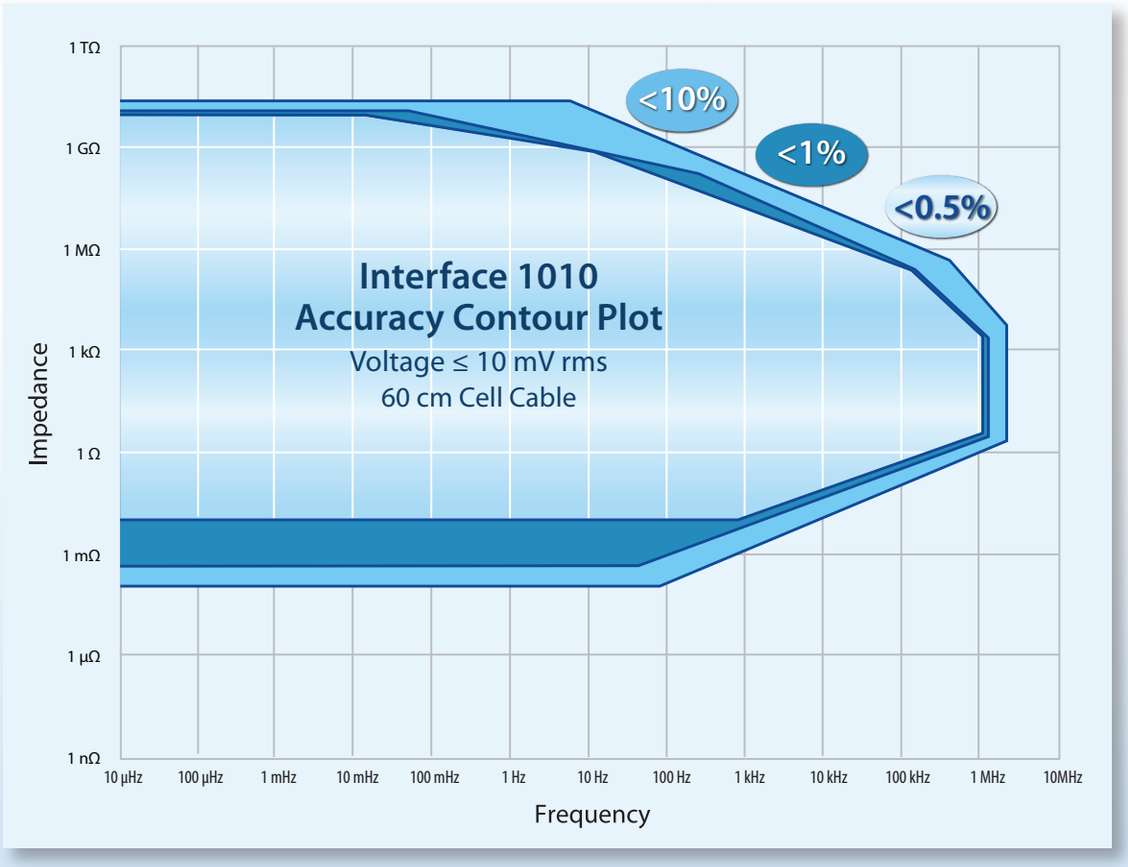
While every potentiostat has some intrinsic noise level caused by electronic components and the laws of physics, board layout and well-designed filtering can reduce its effect on your measurements. Gamry Instruments' engineers have designed the Interface 1010 with one of the lowest noise specifications available.

DSP Mode

By acquiring data at 60 kHz, the Interface 1010 is able to massively oversample for the best signal-to-noise ratio in the industry. Combine DSP acquisition with the low intrinsic noise in the instrument, and you will see how Gamry Instruments brings new meaning to the term *low noise*.

Impedance Done Right

Every Interface 1010 is equipped to perform EIS without requiring an expensive FRA or expansion modules. The built-in Direct Digital Synthesis circuitry generates a pure sine wave that is ideal for electrochemical applications. Thanks to the wide range of currents this instrument can sense, the Interface 1010 can accurately measure impedances from 10^{10} ohms down to 0.001 ohms.

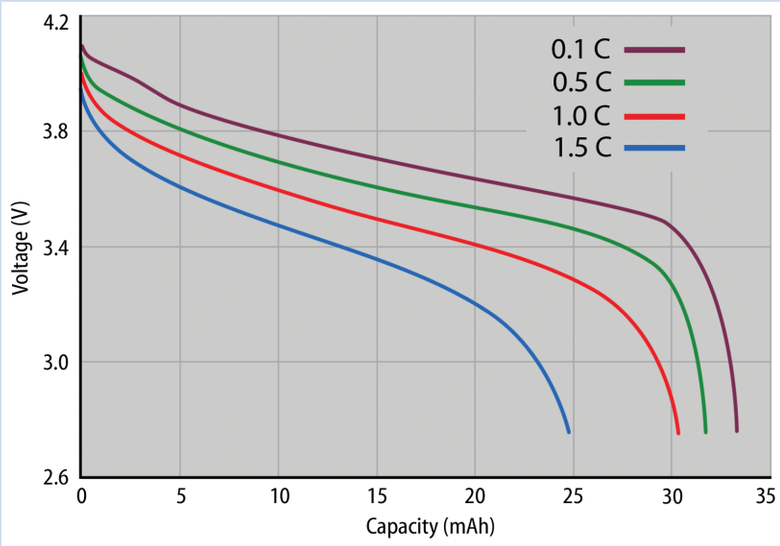


Filters

The Interface 1010 employs a combined total of ten active filters for the Voltage and Current channels. These filters allow for optimal rejection of external signals and noise—which can adversely impact your sensitive measurements. The Interface 1010 automatically selects the best filter for the acquisition mode, while still offering expert users the choice for manual adjustments.

Smart Cell Cables

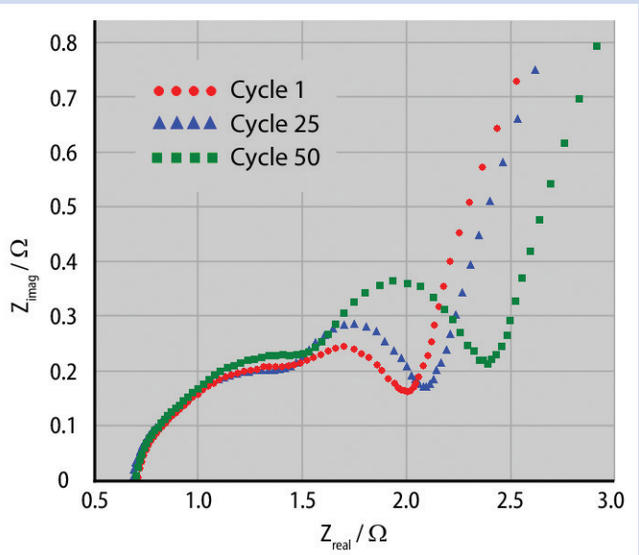
Even the cell cables for the Interface 1010 are impressively engineered for high performance. The standard cell cable is optimized for low stray capacitance and high-resistance isolation between the internal conductors and the shields. You get better EIS results for high-impedance samples and truer signals for high speed experiments. A special low-*Z* cable is available to extend the inductive limit when performing EIS on batteries and supercapacitors.



Discharge curves for a lithium ion 2032 coin cell battery, 40 mAh-rated capacity.

Multi-Stage Cell Switch

We use a sophisticated two-stage cell switch in the Interface 1010 design. The first stage is a relay which insures pure electrical isolation. The second stage consists of an ultra-fast MOSFET switch with zero contact bounce. This second stage offers better signal application with minimal spikes, plus the ability to perform current-interrupt iR compensation.



Selected EIS spectra after charging steps for lithium-ion 2032 coin cell battery, 40 mAh-rated capacity, 10 mA rms.

Differential Electrometer

High impedance and low input current are hallmarks of a Gamry Instruments Differential Electrometer. High impedance ensures no stray current leaks through the measurement circuit. Low input current means that it can detect small variations in voltage. The Interface 1010 employs not just one electrometer, but a second for the Zero Resistance Ammeter. Gamry Instruments potentiostats are simply the best choice for electrochemical noise and galvanic corrosion measurements.

Dual DAC Signal Generation

Two 16-bit Digital-to-Analog converters (DACs) are used to provide the best signal generation possible. By using the Bias DAC to set a DC level and the Scan DAC to provide the scanning signals, we can optimize the resolution and accuracy of the output signal.

THE GAMRY DIFFERENCE

Gamry Instruments provides you with the complete solution to get the answers you need. We carefully consider every detail of system design. Everything from board layout, component selection, signal processing, all the way down to the tip of our smart cell cables, is designed to deliver maximum performance. Our software is intuitive and easy to use yet powerful enough underneath to allow you to customize experiments and interfaces to suit your needs. This combination of features and capabilities give you the maximum amount of performance at incredible value.

SPECIFICATIONS

	Interface 1010T	Interface 1010B	Interface 1010E
Cell Connections		2, 3, 4	
Floating		Yes	
System			
Maximum Current	±100 mA		±1 A
Current Ranges	6		9
Current Ranges (with Gain)	8		11
Minimum Current Resolution	0.3 pA		3.3 fA
Minimum Voltage Resolution		1 µV	
Maximum Applied Potential	±5 V		± 12V
Rise Time		1 µs	
Noise and Ripple		<20 µV rms	
Minimum Timebase	1 ms		10 µs
Maximum Timebase		750 s	
Minimum Potential Step		12.5 µV	
EIS Measurement			
Frequency Range		10 µHz–20 kHz	10 µHz–2 MHz
Impedance Accuracy		99%	See Accuracy Contour Plot
Maximum AC Amplitude		2.33 V rms	
Control Amplifier			
Compliance Voltage		±20 V	
Output Current		> ±1 A	
Speed settings		3	
Unity Gain Bandwidth (typical)		980, 260, 40, 4, 0.4 kHz	
Electrometer			
Input impedance		$>10^{12}$ Ω	
Input current		<20 pA	
Bandwidth (–3 dB) (typical)		>15 MHz	
Common Mode Rejection Ratio		>86 dB (10 kHz), >60 dB (1 MHz)	
Applied Potential			
Accuracy		±1 mV ± 0.2% of setting	
Resolution		12.5 µV, 50 µV, 200 µV/bit	
Potential Scan Range		±0.4 V, ±1.6 V , ±6.4 V	
Measured Potential			
Accuracy		±1 mV ± 0.3% of setting	
Resolution		400 µV, 100 µV, 10 µV, 1 µV/bit	
Applied Current			
Accuracy		±5 pA ± 0.3% of setting	
Resolution		0.0033% full-scale/bit	
Measured Current			
Accuracy		±5 pA ± 0.3% of setting	
Resolution		0.0033% full-scale/bit	
Bandwidth (current range-dependent)		>10 MHz (100 mA–100 µA ranges) >1.5 MHz (10 µA range) >150 kHz (1 µA range)	
Stability Settings		3	
iR Compensation			
Mode		Current Interrupt	
Minimum Interrupt Time		33 µs	
Maximum Interrupt Time		715 s	
Physical Dimensions			
Weight		2 kg	
Size		24 × 6 × 27 cm (W × H × D)	
Cable		60 cm (std); 1.5 m, 3 m, 10 m	

GAMRY INSTRUMENTS
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