PARSTAT® 2273
potentiostat/galvanostat/FRA

- Superior quality and exceptional performance - the ultimate electrochemical tool to satisfy your research needs

- High compliance voltage - up to ± 100V

- Built-in frequency response analyzer providing fully integrated DC and EIS analysis - 10µHz to 1MHz

- PowerSuite software for versatility and ease of use

- Booster interface - 3 current booster options

AMETEK

PARSTAT 2273

The PARSTAT 2273 is the ultimate potentiostat/galvanostat/FRA, boasting superior quality and high reliability. Its exceptional impedance capability, resolution, speed, high current, and high compliance voltage continues to be the standard against which all other systems are measured.

The 2273 is designed to be the most comprehensive potentiostat/galvanostat/FRA in your laboratory. We have incorporated customer feedback to provide not only more internal maximum current but the ability to boost up to 20 A and the ability to interface all the ancillary equipment customers need today for their unique research.

The PARSTAT 2273 provides all the capabilities you need in your laboratory:

- 2 A current max. (20 A boosted)
- 100 V compliance
- 1.2 fA current resolution
- $>10^{13}$ Ω input impedance
- <5 pF of capacitance
- 10µHz to 1 MHz built in analyzer for impedance

Use the PARSTAT 2273 in the following market segments:

- Research Electrochemistry
- Corrosion
- Sensors
- Batteries/Fuel Cells
- Electrodeposition/Plating
- Biomedical Applications

The PARSTAT 2273... setting the standard in research electrochemistry!

General Specifications

The 2273 is an advanced potentiostat/galvanostat/FRA that consists of hardware capable of ± 10 V scan ranges, 2 A current capability, and EIS measurements from 10 µHz to 1 MHz. The interface to the PC or laptop is Universal Serial Bus (USB), so there is no need for an additional card for your system. Electrochemistry PowerSuite software is required for the 2273.

Current and Voltage

Unlike any other potentiostat on the market today, the 2273 offers a unique combination of compliance voltage up to ± 100 V (power available at the counter electrode) and a maximum current of up to ±2 A.

EIS Capability

The 2273 hardware combined with PowerSINE software can perform EIS experiments from 1 MHz to 10 µHz. These measurements can control either potentiostatic (Single Sine, Fast MultiSine, or Mott-Schottky), or galvanostatic (Galvanostatic EIS) experiments.

Booster Interface

The 2273 has three current booster options to choose from:

- 8A/2273 option for 8 A, 50 V Complance
- 10A/2273 option for 10 A, 20 V Compliance
- 20A/2273 option for 20 A, 20 V Compliance
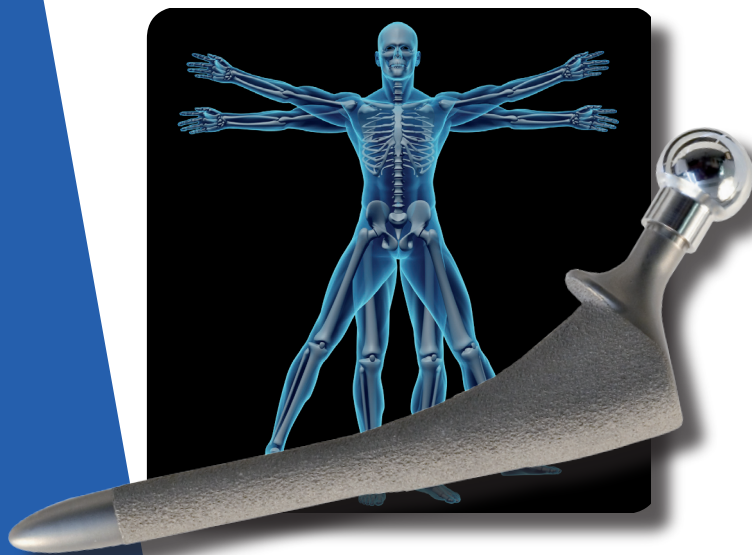
Applications

The physical nature of electrochemistry has resulted in a broad range of research areas. From determining the kinetics of an electron-transfer process, to developing new and improved materials via unique electrodeposition or electrosynthesis techniques, the 2273 was designed with the flexibility and capability required by today's electrochemical researcher. Whether it is a microelectrode, rotating disk electrode, mercury electrode, or quartz crystal resonator being measured, the 2273 supports the wide array of electrodes used in a modern electrochemical research lab.

Corrosion

The 2273 is ideal for corrosion research. For measurements of rebar in concrete or titanium in Ringer's solution, the 2273 was designed to address a wide range of corrosion applications. PowerCORR corrosion software and PowerSINE EIS software complement the 2273's impressive specifications to create the ultimate tool for any corrosion lab. Are you working with large electrodes or resistive media? The 2273's 100 V compliance voltage takes care of that. Studying a new corrosion inhibitor or coating technology? Femtoamp current resolution and $>10^{13}$ Ω input impedance make even the toughest EIS measurements seem routine.

Sensors

For potentiometric sensors (such as ion-selective electrodes and coated wire electrodes) and amperometric sensors (gas sensors, thin film microelectrodes, and chemically modified electrodes), the 2273 provides current sensitivities that can surpass the requirements of the most demanding measurement parameters, with a pA current range and fA resolution, high compliance voltage allows for the growth of thin film electrodes and nanodeposition. Biosensor development and analysis relies on techniques that are contained within the PowerCV , PowerSTEP and PowerPULSE electroanalytical software packages.

Fuel Cells and Batteries

For many years, Princeton Applied Research potentiostats/galvanostats have been utilized to further the development of new energy sources. From the early stages of battery development to the charge/discharge experiments on the final product, the 2273 has the current measurement range to address the challenges that lie ahead for the next generation of batteries. Fuel Cells offer a cleaner energy source for the future and the 2273 helps bring that technology to market. Use EIS to examine the impedance of the PEM at different humidity levels, perform I/V curves on SOFC's, or run CV's

on DMFC assemblies. The 2273 and the entire PowerSuite package have the potential to take your research to the next level.

Biomedical applications

The 2273 exceeds the requirements of a potentiostat/galvanostat as described in ASTM F2129, "Standard Test Method for Conducting Cyclic Potentiodynamic Polarization Measurements to Determine the Corrosion Susceptibility of Small Implant Devices." For implant biocompatibility studies, the most common methods involve DC corrosion techniques such as cyclic potentiodynamic polarization for the determination of the break down or critical pitting potential (Eb), the corrosion or open circuit potential (Ecorr), the repassivation or protection potential (Ep), corrosion current (Icorr) and corrosion rates based on Tafel analysis. All of these techniques are possible with the 2273 using the PowerCORR corrosion measurement software package. The outstanding performance of the 2273 ensures that the results obtained are accurate and allows the user to be confident of their data.
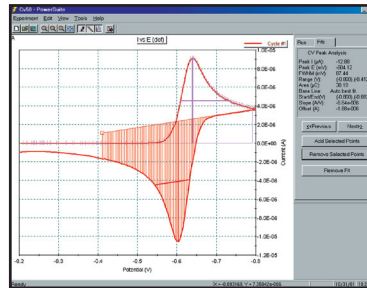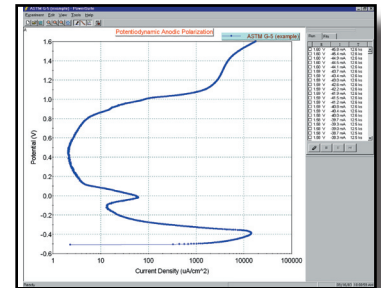
PowerSuite software
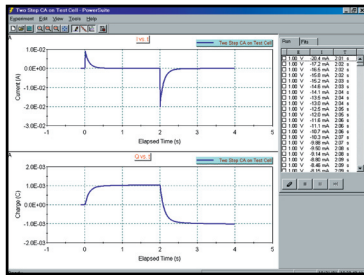
PowerSTEP®

- One Step Chronoamperometry
- Two Step Chronoamperometry
- Chronopotentiometry

PowerCV®

- Linear Scan Voltammetry
- Ramp Cyclic Voltammetry
    - One Vertex
    - Two Vertex
    - One Vertex/Multi Cycle
    - Two Vertex Multi Cycle
- Stair Case Cyclic Voltammetry
    - One Vertex
    - Two Vertex
   - One Vertex/Multi Cycle
    - Two Vertex Multi Cycle

PowerCORR™

- Tafel Plot
- Anodic Polarization
- Linear Polarization
- Potentiostatic
- Galvanostatic
- Ecorr versus Time
- Galvanic Corrosion
- Cyclic Polarization
- Cyclic Polarization (no reverse)
- Zero Resistance Ammeter
- Galvanodynamic
- Galvanodynamic (no reverse)
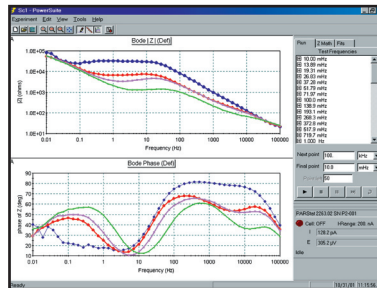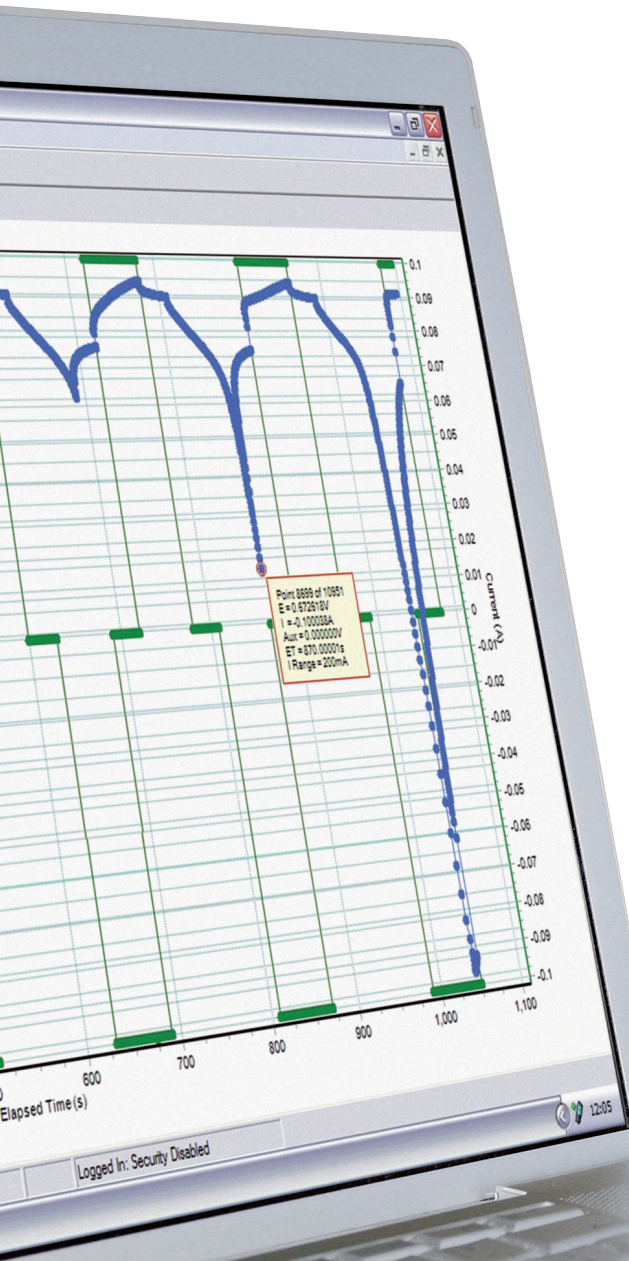
PowerSINE®

- Potentiostatic EIS
- Multi-Sine EIS
- Galvanostatic EIS
- Potentiostatic Impedance versus Time
- Galvanostatic Impedance versus Time
- Mott-Shottky
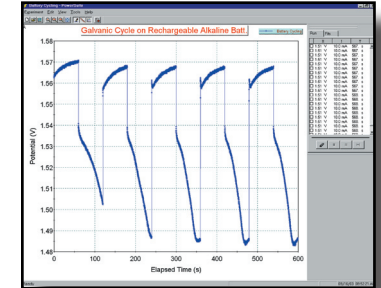
PowerPULSE™

- Recurrent Potential Pulsing
- Recurrent Galvanic Pulsing
- Square Wave Voltammetry
- Cyclic Square Wave Voltammetry
- Differential Pulse Voltammetry
- Cyclic Differential Pulse Voltammetry
- Normal Pulse Voltammetry
- Reverse Normal Pulse Voltammetry

PowerSuite software

Take advantage of powerful wizards, graphical data preseantation formats and easy-to-use import/export tools for both graphs and data.

Experiment Wizard

For new users, the "New Experiment Wizard" guides you through a step-by-step process to configure all aspects of the experiment. If you have a setup that is to be repeated over several experiments, it can be "Saved as a Template…", recalled, and executed without having to re-enter information with each use.
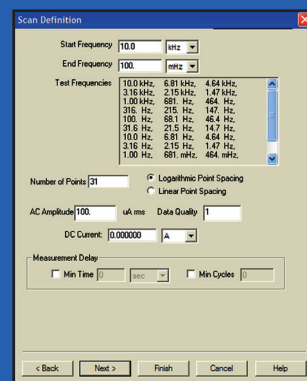

Complete Plotting Control

Overlay data can be placed on the plots prior to acquiring the data, which allows the user to compare the two data sets as the experiment progresses! Overlaid data graphical properties can also be modified in terms of color or plot style, and any overlaid data can be selected to become the "active" data file, at which point the current file becomes an overlay! A number of graphical and analytical features are available by simply right-clicking on any graph and selecting from a full complement of options.
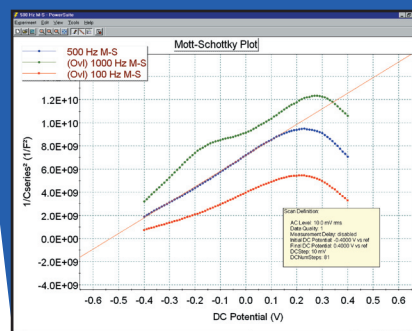

Data Storage Format

PowerSuite's unique data storage format utilizing Microsoft® ACCESS database provides other powerful features available to PowerSuite. These include making changes to some experimental parameters on the fly, performing fits on data as it is being collected, searching data files based on comments added by the user, and exporting data and plots to other programs such as Microsoft Excel and Powerpoint.
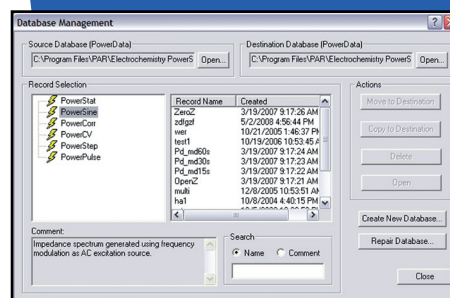
Powerful Graphics

PowerSuite's dominant features are it's graphical capabilities. Tremendous flexibility is provided with data presentation. Up to four plots can be viewed simultaneously, on the screen without opening a separate viewing program. Several default plots are available, and the user has the ability to modify each graph or create and save their own custom graphs according to specified criteria. A wide variety of parameters are available for plotting, as well as the ability to add a second Y-axis or view the plot in 3D. The user can select the data symbols/lines desired, as well as change the color of any plot. Additional graphical features allow the data of any axis to be mathematically changed (by choosing to either add, subtract, divide, or multiply the axis values) using the Data Factors feature. This feature can be used to change data in amps to microamps for comparison purposes. It can also be used to convert a potential reading acquired from an ancillary component (such as a temperature probe) through the A/D Input into its proper value (such as degrees C).
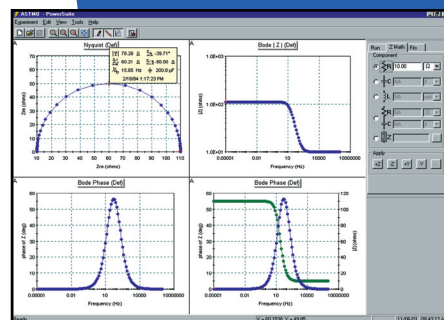
Power Booster

The model 2273 High Current Power Booster can provide 10 or 20 Amps at 20 Volts compliance or 8 Amps at 50 Volts compliance (Reference Voltage remains at ± 10 V). These higher currently handling capabilities are needed for electrochemical applications in battery research, electrodeposition, electrosynthesis, and corrosion on large electrodes.

The booster system operates in potentiostat as well as galvanostat modes. Going between standard mode (2273 stand-alone) and boosted mode is easy requiring only a toggle switch and cell cable change. Requiring factory installation, the booster option can be added with installation scheduled around your research needs.

The overall system frequency response has been modified to provide stability for electrochemical cells in a closed loop that have very high capacitance and very low resistance. Electrochemical Impedance Spectroscopy is still permissible when using a booster, but limited to maximum frequency of 1-10KHz range.

- 8 A, 10 A, and 20 A options

- Operates in boosted or normal mode - simple cable connection converts potentiostat from normal to boosted operation

- Operates in potentiostat or galvanostat mode

- Supplied as a complete system or as an add-on to an existing 2273

- Compatible with Electrochemistry PowerSuite software

PARSTAT 2273 Specification

Power Amplifier

Compliance Voltage	±100 V
Maximum Current	±2 A
Rise Time	<250 ns (No Load)
Slew Time	>15 V/µs (No Load)

System Performance

Minimum Time Base	20 µs
Minimum Potential Step	2.5 µV
Noise and Ripple	<50 µV/rms (typical)
Minimum Current Range	2 nA (hardware)
Minimum Current Range	40 pA (after 50X gain)
Minimum Current Resolution	1.2 fA

iR Compensation

Positive Feedback Range	2000 MΩ to 2 Ω (depending on current range)
Current interrupt	16 bit DAC Potential Error Correction

Current Measurement

Ranges	12 decades, 2 A to 40 pA (with internal gain applied)
Accuracy (dc)	20 µA to 2A: <0.4% Full Scale 20 nA and 1 µA Ranges: <0.5% 2 nA < 0.75%

Differential Electrometer

Input Bias Current	< pA at 25°C
Max. Voltage Range	± 10 V
Max. Input Voltage Differential	± 10 V
Bandwidth	3 dB @ >15 MHz
Common Mode Rejection	>80 dB at 100 Hz
	>60 dB at 100 kHz
Input Impedance	>10^{13} Ω in parallel with <5 pf

General

Power	600 watts Max. 90/130 V AC or 200/260 V AC, 50-60 Hz
Dimensions	58 cm W x 47.6 cm D x 22.9 cm H 20" W x 18.75" D x 9" H
Weight	31 kg (68 lbs)
Temperature	0 - 50° C
Humidity	95% maximum relative humidity, non-condensing
Altitude	Up to 2,000 m

Impedance (EIS)

Mode	Potentiostatic / Galvanostatic
Frequency Range	10µHz to 1MHz
Minimum AC Voltage Amplitude	0.1mV RMS
Sweep	Linear or Logarithmic

Interface

Digital inputs / outputs	5 TTL logic outputs, 2 TTL logic inputs

Interface

Ext In	±10 V analog input. Input impedance is 4.0 kΩ
E Monitor	Front-panel analog output of current readings. Range ±10 V, 50 Ω output impedance
I Monitor	Front-panel analog output of current readings. Range ±10 V 50 Ω output impedance, 0 to ± 2 V corresponds to ±full-scale current range

Interface

DAC voltage output	±10 range BNC Connector (for stirrers, rotating disk electrode, etc.

PC / Software

Communications Interface	Universal Serial Bus (USB)
Operating System	Windows 98/2000/NT/XP/VISTA
PC Specification (minimum)	Pentium 3 (1GHz) / 512MB memory
Software	PowerSINE PowerCORR PowerCV PowerPULSE PowerSTEP

Potential/Current Control

Bias DAC	16 bits Resolution ±10 V Range (Potentiostat) ±100% of full scale current (Galvanostat)
Modulation DAC	16 bits Resolution

Frequency Response (small signal)

2mA Range	3 dB at > 1 MHz, 1k source impedance
20 µA Range	3 dB at >100 kHz, 100k source impedance

PARSTAT® 2273 ordering information

Software

PowerSINE	Electrochemical Impedance Spectroscopy
PowerCORR	Corrosion Measurement
PowerCV	Cyclic Voltammetry
PowerPULSE	Electroanalytical Software
PowerSTEP	Chronoamperometry / Chronopotentiometry

(software sold separately unless purchased as a system 2273-SYS)

Computer Interface

Universal Serial Bus (USB)

Operating System

Microsoft Windows 95/98/2000/NT/XP/VISTA

Options

Power Boosters compatible with the 2273

8A/2273	8A / @ 50 V
10A/2273	10A / @ 20 V
20A/2273	20A / @ 20 V

*Bandwidth reduced with addition of current boosters
**Requires factory installation

Cell Accessories

K0047	Corrosion Cell Kit
K0235	Corrosion Flat Cell
K0264	Micro-Cell Kit
RDE0018	Analytical Cell Kit

Ancillary Equipment

303A	Static Mercury Drop Electrode
507	Interface for model 303A
QCM922	Quartz Crystal Microbalance
616	Rotating Disk Electrode
636	Rotating Ring-Disk Electrode

Princeton Applied Research

www.princetonappliedresearch.com
pari.info@ametek.com

USA

801 South Illinois Avenue
Oak Ridge
TN 37831-0895 USA

Tel: (865) 425-1289
or (865) 482-4411

Fax: (865) 481-2410

Europe

Unit B1 Armstrong Mall
Southwood Business Park
Farnborough
Hampshire GU14 ONR UK

Tel: +44 (0)1252 556800

Fax: +44 (0)1252 556899

AMETEK