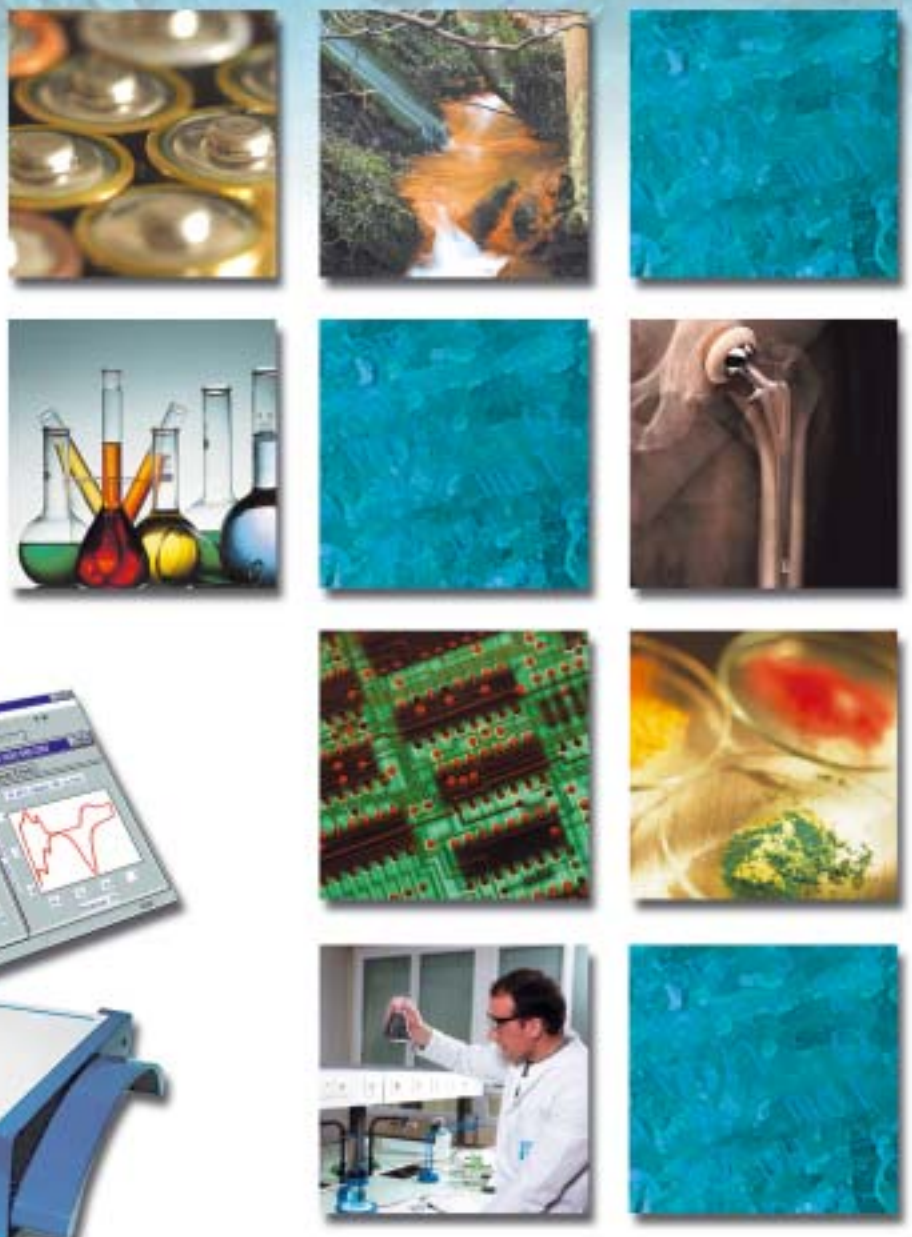
VoltaLab®
Electrochemical Research Equipment

Electrochemistry - Fuel cells - Energy - Environmental Analysis - Corrosion - Education



Radiometer analytical

- when you need to be sure...

VoltaLab®

VoltaLab instrumentation is ideal for dc and ac electrochemical analysis applications in corrosion, pitting tests, battery testing, fuel cells, electroplating, electrocatalysis, nano materials, coatings and sensor development and includes a series of potentiostats and current/voltage boosters.

Get a free poster for your lab

www.voltalab.com

Simplicity

Innovation
VoltaLab offers outstanding software and high-performance hardware with innovative features such as the “Time evolution” concept. This exclusive function represents a veritable revolution in the world of electrochemistry.

All-in-one concept
The VoltaLab “All-in-one” concept is very simple to understand and even simpler to benefit from. One software and one “potentiostat” are all you need! You can run any type of electrochemical experiment. There is no need to install a specific card in your PC. Communication is compatible with USB/RS232C connectors.

Full/Routine
VoltaMaster 4 can be run in full or routine mode. In routine mode, access to programing is restricted, providing additional security.

Customer support
hotline@nalytical.com
We asked VoltaLab users to tell us what would really help them save time. Then we added it to VoltaMaster 4 to offer the most complete electrochemical software on the market.

Exclusive functions
The tools methods is what makes VoltaLab stand out from rival products. It allows you to drive your experiment by creating protocols which respond according to automatically calculated results such as the intensity of a peak or its position.

Maximum efficiency
Concentrate on your research. Forget about technical difficulties. VoltaLab offers the easiest to use and most versatile “All-in-one” potentiostats on the market. See how you can master your electrochemical interfaces with VoltaLab.

Register at www.voltalab.com
When you register to download VoltaMaster 4 software, you will discover that the VoltaLab all-in-one concept is the best solution for your experimental needs, whatever they may be.

Electrochemical Laboratories

Controlled by VoltaMaster 4

Every VoltaLab electrochemical laboratory consists of a potentiostat, VoltaMaster 4 software and a set of cables.

	VoltaLab 21	*VoltaLab 10*	*VoltaLab 40*	*VoltaLab 50*	*VoltaLab 80*
Auto Peak Analysis	•	•	•	•	•
"Time evolution"				•	•
Scan rate	0.01 V/s	0.5 V/s	20 V/s	20 V/s	20 V/s
Best current resolution	100 pA	30 pA	30 pA	0.3 pA	0.3 pA
EIS Maximum frequency		100 kHz	100 kHz/40 kHz		100 kHz/40 kHz
EIS Modes		Potentiostatic	Potentiostatic Galvanostatic		Potentiostatic Galvanostatic
Recommended for	Corrosion	Education	Development	Quantitative analysis	Fundamental research

VoltaLab 21

Self-contained system equipped with programmable controls on the front panel. Able to function both in floating and non-floating mode.

VoltaLab 10

All-in-one system which brings you a multitude of functions in a compact box at an unbeatable price.

VoltaLab 40

Dynamic system which combines outstanding performance and ease of use. A major breakthrough in the field of ohmic drop compensation with dynamic compensation controlled by impedance measurement.

VoltaLab 50

Analytical system which offers the convenience required for routine use of cyclic voltammetry in quantitative analysis.

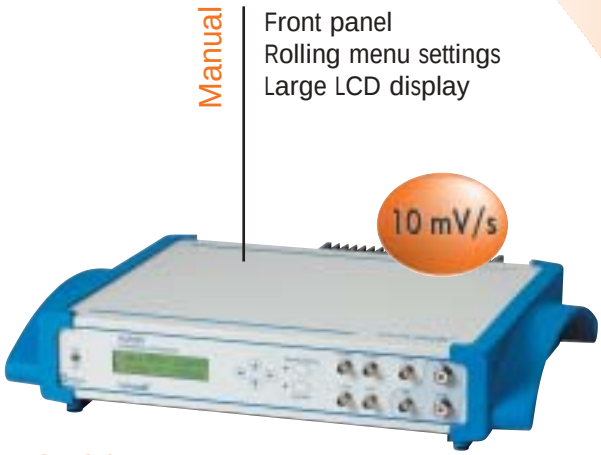
VoltaLab 80

Universal system which enables you to develop and perform all current electrochemical experiments, even the most complex. Automatic processing and efficient peripheral management functions.

See page 25 for additional units

VoltaLab 21

Economical Electrochemical Laboratory



VoltaLab 21 is a compact potentiostat/galvanostat with built-in signal generator that can be used as a stand-alone instrument when it is programmed through its front panel. In this manual mode, the potentiostat scan rate can be selected up to 2.5 V/s. With VoltaMaster 4, the maximum scan rate is 10 mV/s. Ideal for **corrosion** studies, VoltaLab 21 records the polarisation resistance and the corrosion potential over very long periods. Pitting tests as well as coupled corrosion tests are available. VoltaLab 21 works either in **floating or non-floating mode**.

PGP201

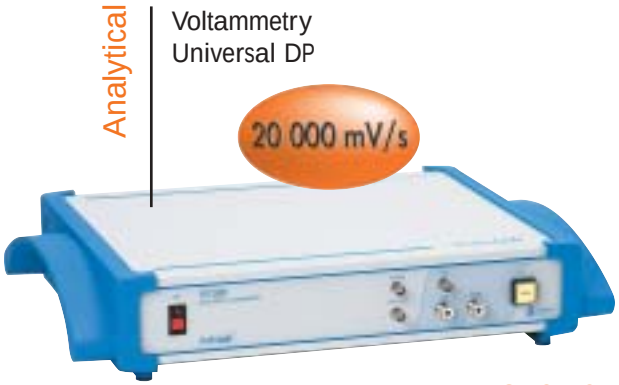
Economical Potentiostat

Voltammetry

Maximum compliance voltage	±20 V
Maximum current output	±1 A
Maximum polarisation voltage	±4 V

Ordering information

VoltaLab 21 (230 V)	A41A009
VoltaLab 21 (115 V)	A41A010



PST050

Analytical Potentiostat

Ordering information

VoltaLab 50 (230 V)	R21V015
VoltaLab 50 (115 V)	R21V016

VoltaLab 50

Analytical Electrochemical Laboratory

VoltaLab 50 is an analytical quantitative laboratory which automates and simplifies any type of electrochemical analysis using standard addition, standard calibration and calibration by addition. Everything is made easy and practical. For instance the spectrums can be automatically compared to reference spectrum in order to establish a “pass or fail“ protocol. User-selectable units and blank and dilution factor management are some of the fundamental features provided. Every DC technique can be set and run, including the extraordinarily powerful Universal Differential Pulse method.

Voltammetry

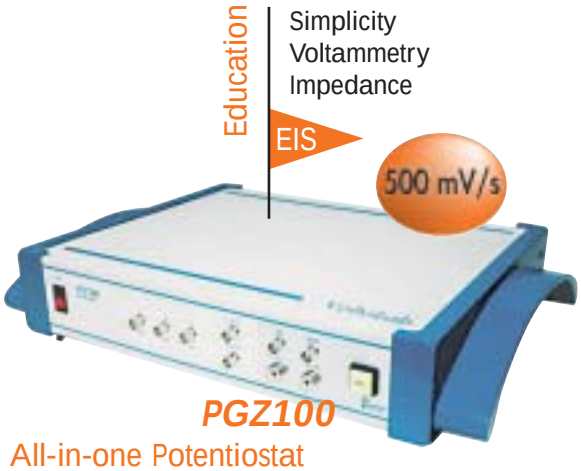
Maximum compliance voltage	±30 V
Maximum current output	±1 A
Maximum polarisation voltage	±15 V

See page 7 and 8 for more technical data

VoltaLab 10

All-in-one Electrochemical Laboratory

VoltaLab 10 is an all-in-one system which brings you a multitude of functions in a compact box at an unbeatable price. As it is the easiest to use "all-in-one" potentiostat on the market, it is the obvious choice for teaching or for beginners in electrochemistry. It offers Voltammetry and Electrochemical Impedance Spectroscopy.



PGZ100

All-in-one Potentiostat

Voltammetry

Maximum compliance voltage	±30 V
Maximum current output	±1 A
Maximum polarisation voltage	±15 V

Electrochemical Impedance

Max. frequency	100 kHz
Min. frequency	1 mHz

Ordering information

VoltaLab 10 (230 V)	R21V011
VoltaLab 10 (115 V)	R21V012

VoltaLab 40

Dynamic Electrochemical Laboratory

VoltaLab 40 is a dynamic system which combines outstanding performance and ease of use. It represents a major breakthrough in the field of ohmic drop compensation by offering dynamic compensation controlled by impedance measurement. It is the obvious choice for high-level researchers. As it is the easiest to use and most versatile "all-in-one" potentiostat on the market, it is ideal for Electrochemical Impedance Spectroscopy combined with conventional methods such as Voltammetry.

PGZ301

Dynamic Potentiostat

Voltammetry

Maximum compliance voltage	±30 V
Maximum current output	±1 A
Maximum polarisation voltage	±15 V

Ordering information

VoltaLab 40 (230 V)	R21V007
VoltaLab 40 (115 V)	R21V008

Electrochemical Impedance

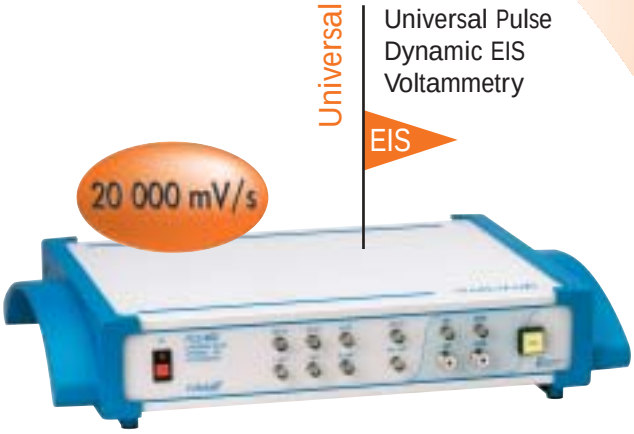
Max. frequency	100 kHz
Min. frequency	1 mHz

See page 7 and 8 for more technical data

VoltaLab 80

Universal Electrochemical Laboratory

VoltaLab 80 is a universal instrument that will serve your imagination, making the use of delicate electrochemistry so simple and efficient that you will benefit from its potential straightaway. Everything is available from the simplest tutorial to the ultimate state-of-the-art methods, the "Universal Differential Pulse". These universal methods exist either in recurrent mode (for battery testing) or over a potential ramp for analytical purposes. VoltaLab 80 is the most versatile potentiostat and software combination around.



PGZ402

Universal Potentiostat

Voltammetry

Maximum compliance voltage	±30 V
Maximum current output	±1 A
Maximum polarisation voltage	±15 V

Electrochemical Impedance

Max. frequency	100 kHz
Min. frequency	1 mHz

Ordering information

VoltaLab 80 (230 V)	R21V009
VoltaLab 80 (115 V)	R21V010

Bipotentiostat

Combination of 2 potentiostats (see p. 25)

You can obtain a 2 separate working electrode system **immediately** with VoltaLab. Simply combine two potentiostats to obtain a bipotentiostat. Two working electrodes, one counter electrode and one reference electrode. The ring and disc currents are saved in the same file.

*Possible combinations

PGZ402 + PGZ402
PGZ402 + PGZ301
PGZ402 + PGZ100
PGZ402 + PST050
Recommended:
PGZ100 + PST050
PGZ301 + PGZ100
PGZ301 + PST050
PGZ301 + PGZ301
PGZ100 + PST050

Hardware

Electrical specifications

	VoltaLab 50	VoltaLab 80	VoltaLab 40	VoltaLab 10	VoltaLab 21
Compliance voltage	±30 V*	±30 V*	±30 V*	±30 V*	±20 V
Maximum current output	±1 A	±1 A**	±1 A	±1 A	±1 A
Polarisation voltage	±15 V	±15 V	±15 V	±15 V	±4 V
Slew rate	10000 KV/s	10000 KV/s	10000 KV/s	10000 KV/s	300 KV/s
Rise time (100% signal)	< 1µs	< 1µs	< 1µs	< 1µs	< 4 µs
Bandwidth (-3dB)	800 kHz	800 kHz	800 kHz	800 kHz	200 kHz
Current autoranging	Yes	Yes	Yes	Yes	Yes
Potential autoranging	Yes	Yes	Yes	Yes	Yes
Measurements (A/D converters)	16 bits	16 bits	16 bits	16 bits	20000 points
Applied DC potential					
Ranges	±4, 8, 15 V	±4, 8, 15 V	±4, 8, 15 V	±4, 8, 15 V	±4 V
Best resolution	125 µV	125 µV	125 µV	125 µV	125 µV
Accuracy (% of range)	±0.2%	±0.2%	±0.2%	±0.2%	±0.2%
Measured potential					
Ranges	±2, 4, 8, 15 V	±2, 4, 8, 15 V	±2, 4, 8, 15 V	±2, 4, 8, 15 V	±8 V
Best resolution	60 µV	60 µV	60 µV	60 µV	1 mV
Resolution (% of range)	0.003%	0.003%	0.003%	0.003%	0.0125%
Accuracy (% of range)	±0.2%	±0.2%	±0.2%	±0.2%	±0.2%
Analogue output	Yes	Yes	Yes	Yes	Yes
DC offset and gain (10 & 100)	Yes	Yes	Yes for EIS	Yes for EIS	No
Measured current					
Highest range	1 A (9 ranges)	1 A (9 ranges)	1 A (7 ranges)	1 A (7 ranges)	1 A (7 ranges)
Lowest range	**10 nA** (with gain)	**10 nA** (with gain)	1 µA	1 µA	1 µA
Best resolution	300 fA (with gain)	300 fA (with gain)	30 pA	30 pA	100 pA
Resolution (% of range)	0.003%	0.003%	0.003%	0.003%	0.01%
Accuracy (% of range)	±0.2%***	±0.2%***	±0.2%***	±0.2%***	±0.2%***
DC offset and gain (10 & 100)	Yes	Yes	Yes for EIS	Yes for EIS	No
Analogue output	Yes	Yes	Yes	Yes	Yes
Automatic filters	Yes	Yes	Yes	Yes	Yes
Manual filters	7 filters	7 filters	7 filters	7 filters	5 filters
Anti-oscillation filter	Yes	Yes	Yes	Yes	No
Scanning performances					
Measurement period	0.5 ms	0.5 ms	0.5 ms	20 ms	1 s
Max. scan rate (10 mV steps)	**20 V/s**	**20 V/s**	**20 V/s**	**500 mV/s**	**10 mV/s**
Ohmic Drop Compensation					
Dynamic Impedance Driven	Yes	Yes	Yes	No	
Static manual & Static auto	Yes	Yes	Yes	Yes	
Feedback manual & Feedback auto	Yes	Yes	Yes	No	
Electrochemical Impedance					
Max. frequency		100 kHz	100 kHz	100 kHz	
Min. frequency		1 mHz	1 mHz	1 mHz	
Frequencies/decade		5, 10, 20	5, 10, 20	5, 10, 20	
Sine wave amplitude		1 mV to 1 V	1 mV to 1 V	1 mV to 1 V	
Ranges for AC potential		50 & 1000 mV	50 & 1000 mV	50 & 1000 mV	
Resolution		12.5 & 250 µV	12.5 & 250 µV	12.5 & 250 µV	
Accuracy (% of range)		±0.5%	±0.5%	±0.5%	
Current autoranging		Yes	Yes	Yes	
Delay before integration		Yes	Yes	Yes	
EIS distortion for module		1% ±(0.02%/kHz)	1% ±(0.02%/kHz)	1% ±(0.02%/kHz)	
EIS distortion for phase shift		1°±(0.02°/kHz)	1°±(0.02°/kHz)	1% ±(0.02%/kHz)	

* Can be increased to 100 V with the HVB100 High Voltage Booster
** Can be increased to 20 A with the HCB020 Current Booster
*** 1% with 100 nA and 10 nA range

Connections

	VoltaLab 50	VoltaLab 80	VoltaLab 40	VoltaLab 10	VoltaLab 21
Rear panel connections					
Functional ground to connect a Faraday cage	Banana				Banana
Serial port to connect a Pentium based PC	RS232C				SUB-D9 male
Cell connections					
REF (Reference Electrode, RE)	BNC				BNC
Input impedance	10^{12} Ohm				10^{12} Ohm
Capacitance	<20 pF				<20 pF
WORK (Working Electrode, WE)	PL259				PL259
Output impedance	Low				Low
AUX (Auxiliary Electrode, CE)	PL259				PL259
Output impedance	Low				Low
Additional channel connections					
E OUT (Measured potential output)	BNC				BNC
Range	±15 V				±8 V
Accuracy (% of range)	±0.2%				±0.2%
I OUT (Measured current output)	BNC				BNC
Range (Linear with current range)	±1 V				±1 V
Accuracy (% of range)	±0.2%				±0.2%
Vg IN (External Generator)	BNC				BNC
Range	±10 V				±5 V
Input impedance	10 kOhm				20 kOhm
Additional cell connections					
SENSE (For 4-pole measurements)	BNC				
Input impedance	Low				

Additional channels

	VoltaLab 50	VoltaLab 80	VoltaLab 40	VoltaLab 10	VoltaLab 21
A/D IN (Input)	BNC				
Range	±5000 mV				
Resolution	152.5 µV				
Accuracy (% of range)	± 0.1%				
Input impedance	10 MOhm				
Input synchronised with E & i					
D/A OUT (Output)	BNC				
Range	0 - 5000 mV				
Resolution	1.2 mV				
Accuracy (% of range)	±0.05%				
Additional Unit connections					
Vg OUT (To external potentiostat)	BNC				
Range	±15 V				
Output impedance	Low				
E (X) IN (Channel X)	BNC				
Range	±15 V				
Input impedance	10 KOhm				
I (Y) IN (Channel Y)	BNC				
Range	±1 V				
Input impedance	10 KOhm				

Synchronisation

The A/D IN input is synchronised with potential and current acquisitions. It can be used to record the temperature or any other useful data. The D/A OUT output is synchronised with the start of any method. It can be used to set the speed of a rotating electrode or to start or regulate any other experimental instrument.

General

Power supply	115/230 Vac + 15-18% 47.5-63 Hz
Size & Weight	485 x 300 x 88 mm & 13 kg

Software

VoltaMaster 4

This superb software is the cornerstone of your VoltaLab Electrochemical Laboratory.

Designed by electrochemists

The only way to satisfy users' requirements is to listen to what they have to say. That's our policy. To tell the truth it is you, the electrochemists, who have designed the VoltaLab family of instruments.

Simple to use

Programming, archiving and data handling could not be easier. Whether you are an absolute beginner or an expert, it takes five minutes to feel confident with VoltaLab thanks to intuitive multitasking software.

VoltaMaster 4 minimum PC requirements

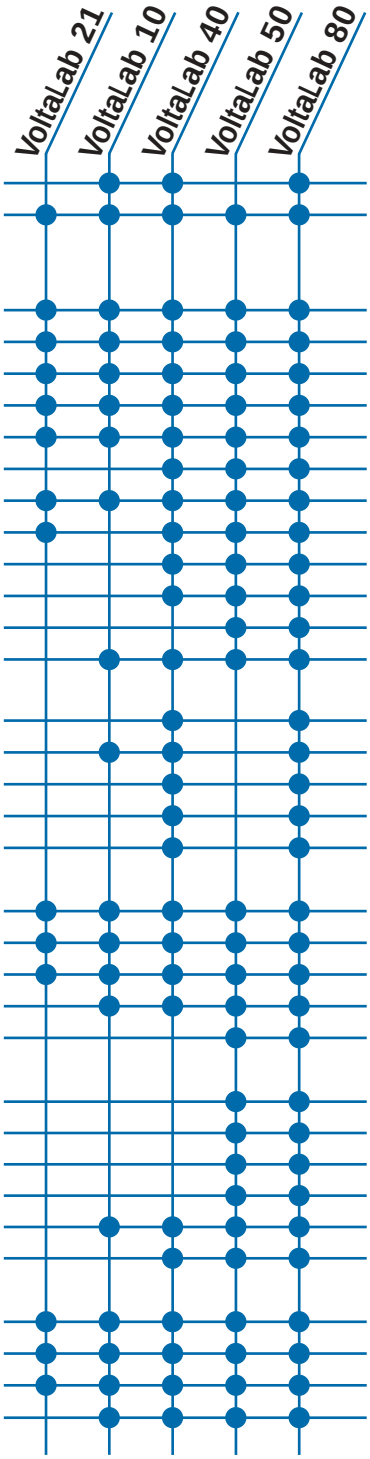
- 64 MB of RAM, 50% free space
- Microsoft Windows® 95, Windows® 98, Windows® NT 4.0, Windows 2000 Professional edition, Windows Millenium or Windows XP
- Microsoft Excel 97 for users working with the VM4RESULTS.XLS calculation results file
- Pentium II 400 MHz microprocessor
- CD-ROM drive
- RS232C serial interface - PC with USB port only: use a separate USB to RS232C converter box
- Printer connection
- VGA colour graphics card (min. screen resolution 600x800 on the "Desktop")
- Windows compatible mouse
- 2 GB hard disk, 50% free space

Free upgrade

Visit www.voltalab.com and register your VoltaLab system to benefit from your free VoltaMaster 4 latest version right now!

34 acquisition methods

to measure experimental data



- **Voltammetry**
- **Electrochemical Impedance**
- **Analytical pulses**
- **Corrosion**
- **Battery / Energy**
- **Material testing**

Visual methods

Visual EIS
Visual IFV

Electrochemical methods

Open Circuit Potential
Pot. Tutorial Cyclic Voltammetry
Pot. Tutorial Chrono Amperometry
Pot. Interactive Cyclic Voltammetry
Pot. Linear Voltammetry
Gal. Linear Voltammetry
Pot. Cyclic Voltammetry
Gal. Cyclic Voltammetry
Pot. Step by step Cyclic Voltammetry
Gal. Logarithmic Cyclic Voltammetry
Pot. Low Current Cyclic Voltammetry
Tast Polarography

Pot. Expert EIS
Pot. Tutorial EIS (Impedance)
Pot. Dynamic EIS (Impedance)
Pot. Fixed Freq. EIS (Capacitance)
Gal. Tutorial EIS (Impedance)

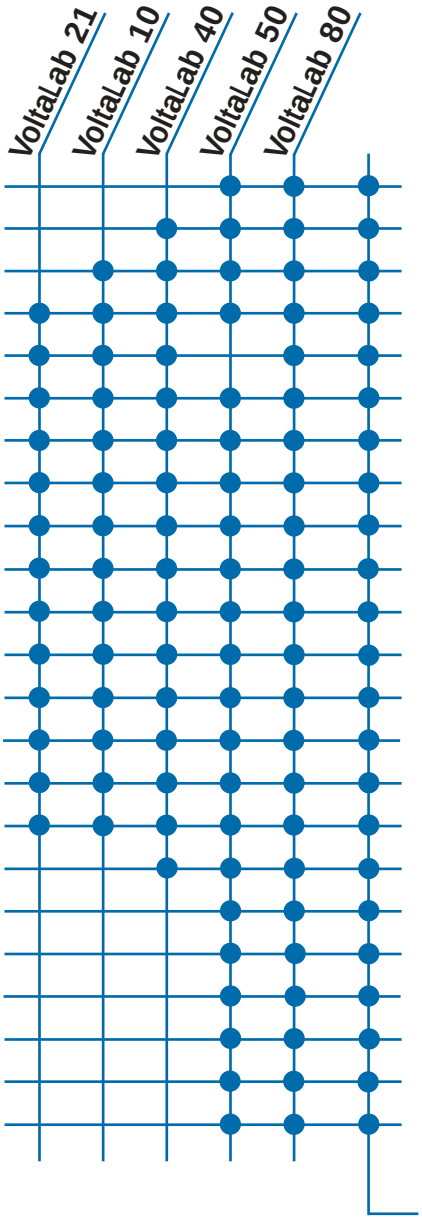
Chrono Amperometry
Chrono Coulometry
Chrono Potentiometry
Gal.Coulometry
Low Current Chrono Amperometry

Pot. Universal Differential Pulse Voltammetry
Gal. Universal Differential Pulse Voltammetry
Pot. Recurrent Differential Pulse Voltammetry
Gal. Recurrent Differential Pulse Voltammetry
Pot. Square Wave Voltammetry
Gal. Square Wave Voltammetry

Pitting corrosion
General corrosion (Rp)
Coupled corrosion (Evans)
Polarisation for corrosion (Tafel)

23 tool methods

to organise protocols and calculate results



Run External Utility
Auto. Peak Analysis
Auto. R1R2C Fitting
Auto Linear Extraction
Vg IN On/Off
Auto. Traject
Message
Relocate potentials
If/if not method
Jump to method
Last point
Current efficiency
Print report
Yes or No?
Save curve as
Sort out by potential
Results from Results: Linear combination of results
Time evolution
Standard addition
Standard calibration
Calibration by addition
Calibration CV ST
Sample CV ST

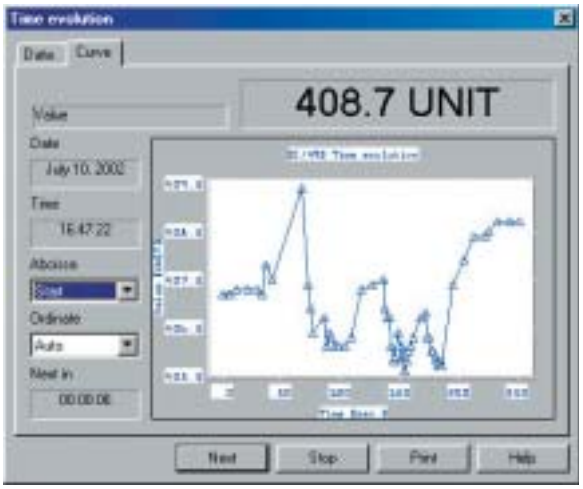
Virtual mode

- **Automatic Calculation**
- **Automatic Report**
- **External Utility Control**
- **Dialogue boxes**
- **Time Evolution**
- **Data Quality Management**
- **Loops**

“Time Evolution”

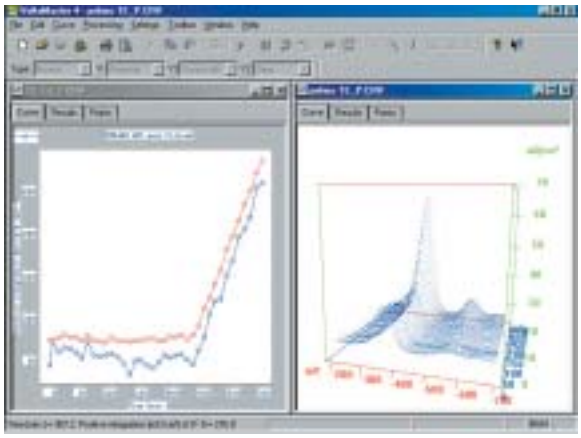
Exclusive and outstanding

Time evolution lets you record the calculated results as a function of time. This method takes place within a loop: measurement, calculation, Time evolution, jump to measurement… as many times as you need. Investigating material ageing or new sensor performance has never been so easy.



Protocol organisation

Time evolution not only displays these values; it also compares the last result with a set high and low value. This means action can be taken straightaway, for example automatically adding reagent from a burette.

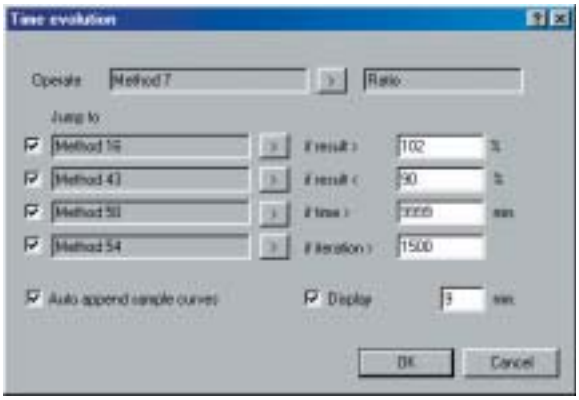


3-D plot

Imagine that in addition to your experimental voltammetry you will get one calculated results curve plus a file containing all the curves used for the calculations. You can display a representation in 3-D.

Data Quality Management

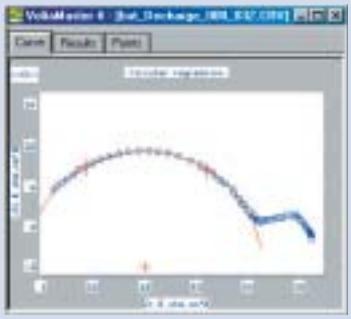
This calculated curve is plotted on the screen during acquisition. The last value, date and time of its acquisition and countdown until the next measurement are all displayed so you know your exact progress. You can adjust the scale manually for a clearer overview.
The value is expressed in the unit and with the name selected in the calculation method.



Electrochemistry with Time Evolution:

Battery discharge followed by EIS

- Galvanic Tutorial EIS
- Auto R1R2C
- Time Evolution

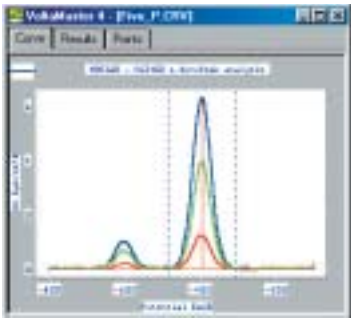


EIS spectrum

The battery is discharged at constant current. Galvanostatic impedance is performed at regular intervals. The R2 value is plotted against time with "Time Evolution".

Routine analysis with polarography

- Run External Utility
- Chrono Amperometry
- Pot. Universal DP
- Auto Linear Extraction
- Standard Calibration
- Time Evolution



Universal Differential Pulse

Anodic stripping with Universal Differential Pulse. Nitrogen bubbling, stirring and mercury drop renewal are all automated. The quantitative result can be calculated from the peak height, the peak position or the area between two potential limits.

Monitoring plating bath efficiency

- Chrono Potentiometry
- Pot. Coulometry
- Current Efficiency
- Time Evolution

Chrono potentiometry

An aliquot taken from the actual production bath constitutes the sample. Constant potential deposition is followed by potentio-dynamic stripping. The ratio between the deposition charge and the stripping charge measures the efficiency of the bath. Alarm thresholds can be set.

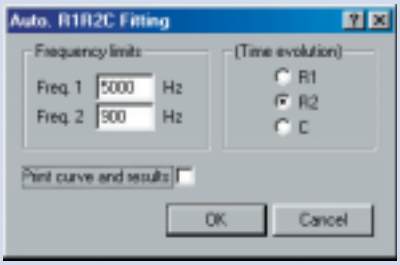
Pitting tests

- Pitting
- Auto Traject
- Last Point (pitting)
- Time Evolution (pitting)
- Time Evolution (Repassivation)

Pitting test (voltammetry)

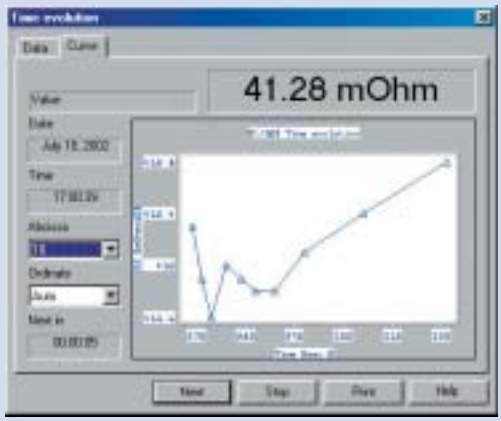
The sample is anodically polarised until pitting starts (current level). Then the potential is scanned back cathodically in order to determine the repassivation potential (current level).

Auto R1R2C Fitting

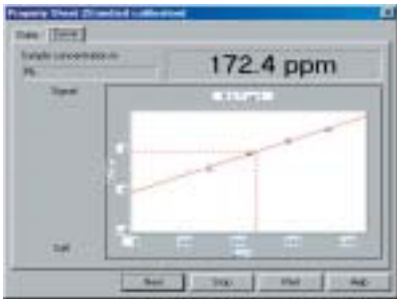


Circular regression between two predefined frequency limits.

The electroactive surface is taken into account in the calculation. The same experimental file can be used by several calculation methods and their respective "Time Evolution" methods so you can follow R1, R2 and C for each semicircle.
It is also possible to follow the modulus or the phase at a given frequency.

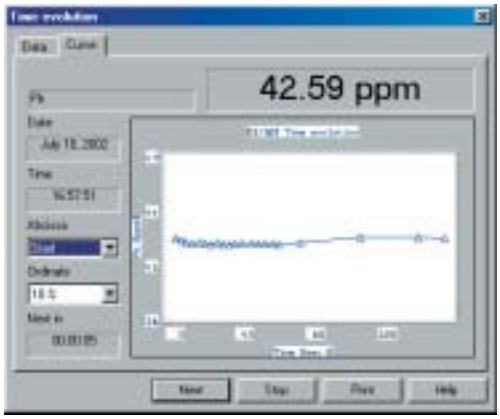


Standard Calibration

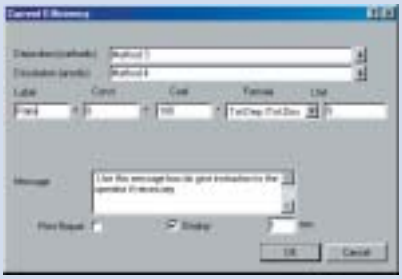


Interpolation through a calibration curve.

Quantitative calculation is provided either by standard addition or by calibration. In calibration mode, linear as well as logarithmic or exponential regression modes are available with blank subtraction if needed. Several species can be followed as several calculation methods and their respective "Time Evolution" methods can use the same experimental file.

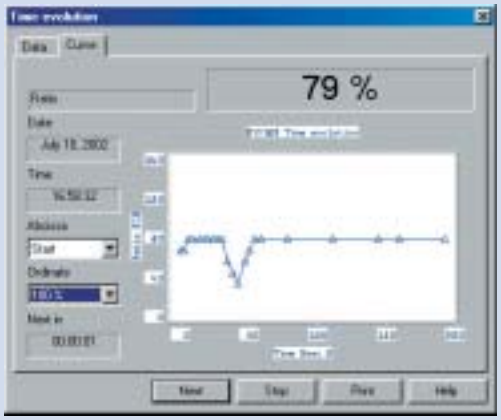


Current Efficiency

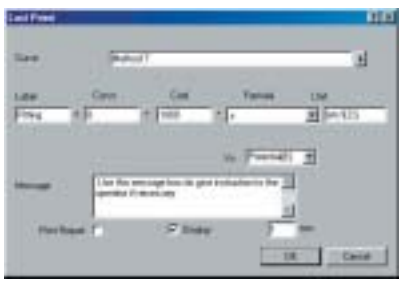


Ratio between deposition and stripping charges.

Using a pair of experimental curves, a number of different indices featuring the respective anodic and cathodic charges can be calculated. Another useful function allows experimental curves obtained each cycle to be compared with a reference curve already archived.

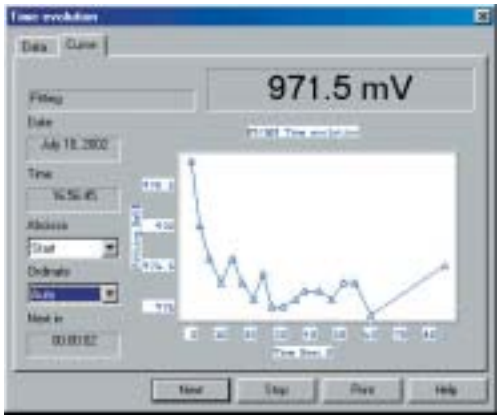


Last Point

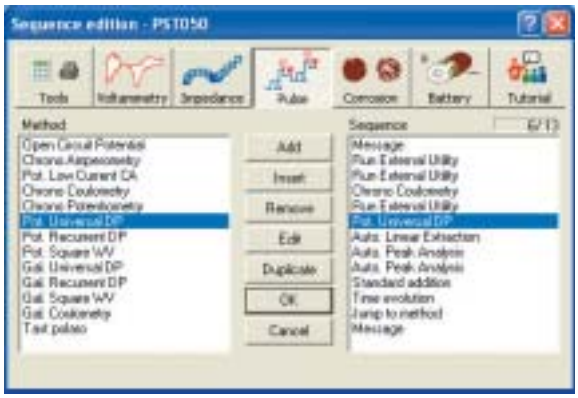


Selection of the last point co-ordinate in anodic polarisation (potential).

The last potential of the anodic polarisation corresponds to the potential at which the set current limit is reached. In addition, by choosing Auto Peak Analysis in combination with Time Evolution, you can follow the maximum current reached during the test.

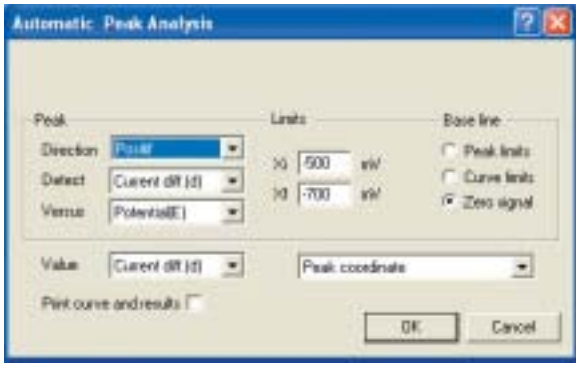


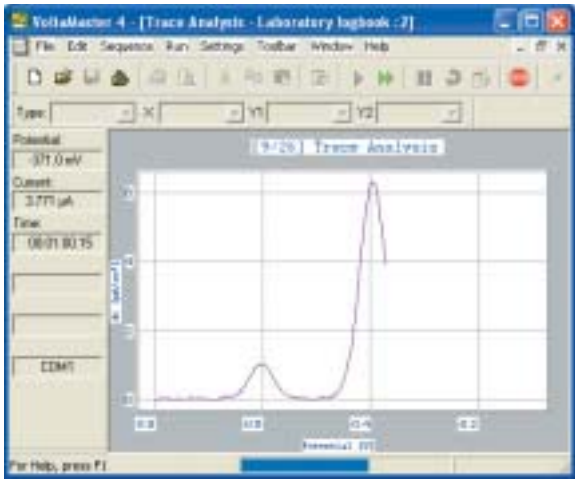
VoltaMaster 4 step by step



You create a sequence to organise measurements.

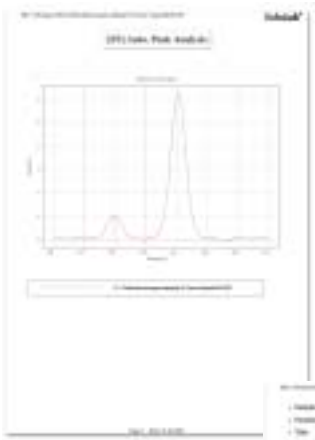
This sequence includes calculations.

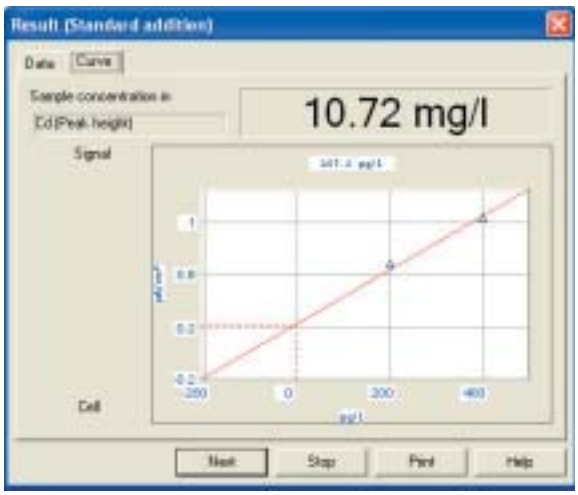




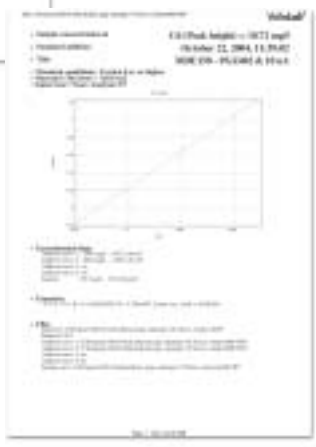
Real time plot during aquisition.

Automatic print out of calculations.





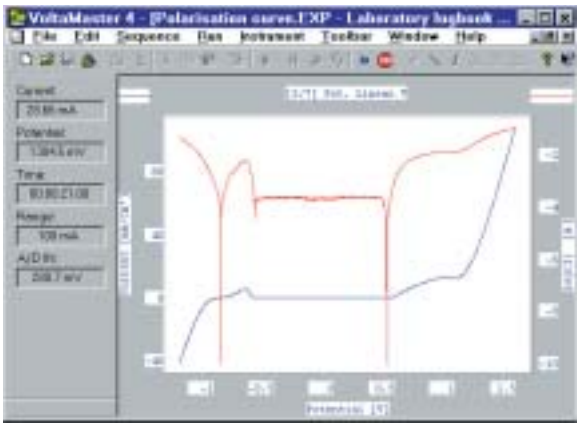
Display of results.



Printing of results.

Corrosion

with VoltaLab 21/10/40/50/80



Corrosion tests

Corrosion tests typically consist of a Polarisation curve, Tafel analysis, Pitting test, Polarisation Resistance or Evans tests.

Polarisation curve

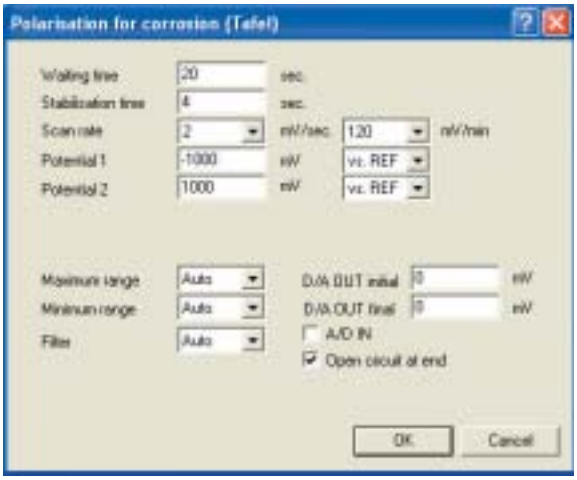
It is simple to obtain a polarisation curve according to **ASTM G3 and G5**, for instance. Both Tafel and Stern calculations can be performed to achieve corrosion parameter determination.

Tafel analysis

The corrosion current density expressed in loss of metal thickness per year is determined from the Tafel equation. The thermodynamic ba and bc parameters of the Butler Volmer equation are also obtained.

2nd Stern analysis

A parabolic regression determines the Rp as the slope of the tangent of the voltammetric curve at the zero-current potential.



Pitting test

The “pitting potential” of stainless steel corresponds to the potential at which the current starts to increase on the anodic scan and the “repassivation potential” corresponds to the potential at which the current becomes negligible on the reverse (cathodic) scan. A **“repassivation potential”** close to the **“pitting potential”** indicates that the sample is capable of reprotecting itself easily after pitting.

Polarisation resistance test

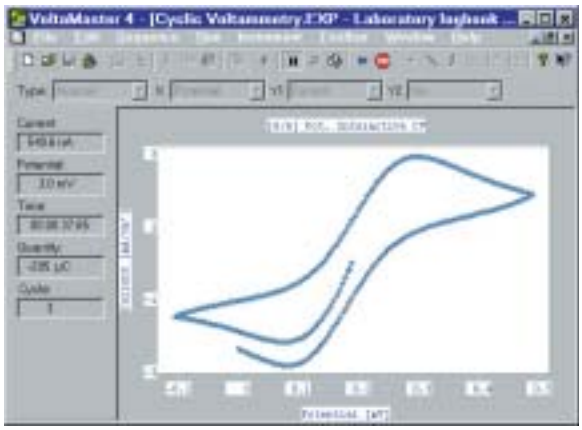
The Rp polarisation resistance helps to evaluate the anti-corroding strength of a corrosion inhibitor or to study a **uniform corrosion** process. The Rp variations versus time are automatically recorded. Each experimental point (Rp value and rest potential) is obtained from one individual voltammetry which is automatically processed with selectable algorithms (Linear, Stern, GFC etc.). Individual voltammetries are also saved. Between two Rp determinations, the system is left at rest (the circuit is open) for a time delay set by the user.

Evans test

Coupled corrosion is also called **bimetallic corrosion** or galvanic corrosion. It occurs when two different materials subject to corrosion are in contact with each other and with the same solution. The less noble material suffers from corrosion, as predicted by the thermodynamic potentials of these materials. Evans experiments determine the corrosion current which is expected to take place at “rest” potential taking into account the areas. A variation of the relative surface area can be simulated in post-run processing.

Voltammetry

with VoltaLab 10/21/40/50/80



Interactive CV

The Interactive Cyclic Voltammetry method replaces the need to use the front panel of the analogue potentiostat with the additional advantage of a digital function as results are saved as files. Interactivity is available up to 300 mV/s.
You operate a CV interactive as if you were using an analogue instrument. You can change parameters and also clear the memory (which corresponds to a "new" sheet if we compare it with a chart recorder). It could not be more convenient.

Real-time display

Your instrument permanently displays and records the current density (i), the working electrode potential (E), the total charge (Q), the synchronised additional channel input (A/D IN) and the time (t) elapsed on the run bar. The experimental curve is also plotted in real time. Even when you decide to "Hold" the potential, the data are saved. There is no maximum time or memory size limit! At the end of the experiment, you can extract the significant part of the experimental curve and save it as a separate file.

Be interactive

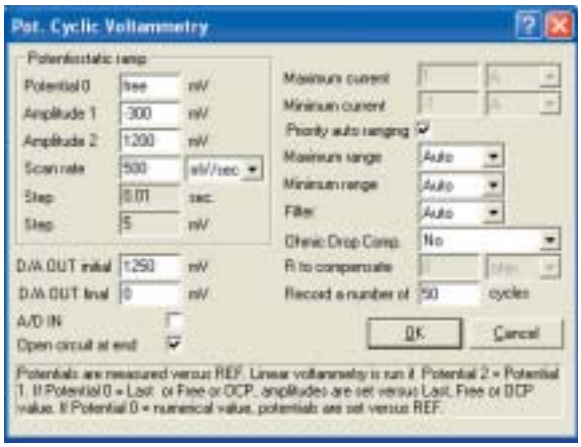
While running an interactive cyclic voltammetry, you can modify the scan rate and/or the potential settings and/or reverse the sweep direction and/or hold the potential for as long as you wish. You are in control!

Benefit fully from interactivity

Imagine that you are running a voltammetry. You observe a peak and want to start a chronocoulometry immediately and at this exact peak potential. It is child's play with VoltaLab since relative electrochemistry is combined with interactivity!

Relative electrochemistry

The Pot. Linear Voltammetry offers a very convenient specification: you can quote the initial potential versus OCP and the final potential versus REF. Then you can polarise the electrode starting from this potential and finish recording your experiment. The benefit is that the potential is gradually driven from OCP towards the starting potential of the CV.

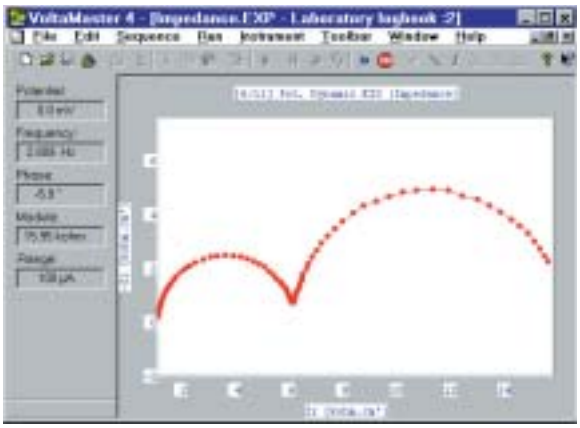


CV interactive control panel

Hold/Continue	holds the potential/ continues to scan the potential
Start	starts the active sequence
Reverse	reverses the scan direction
Modify	modifies the potential set-points, the scan rate, the number of cycles and clears the page
Next	skips to the next method within the sequence
Stop	stops the experiment and opens the circuit

Impedance

with VoltaLab 10/40/80

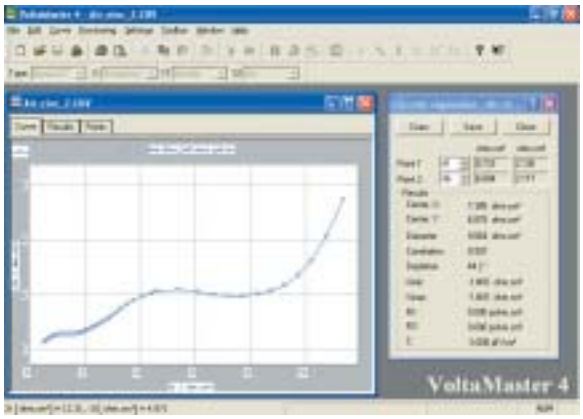


Expert EIS

Optimise your acquisition by taking advantage of current autoranging, the delay before integration and the easy definition of sub-scans with individual settings.

Real-time display

Nyquist (-Zimaginary versus Zreal) or Bode (modulus and phase shift versus logarithm of frequency) with Dynamic EIS method and (Zreal, -Zimaginary) versus potential during a potential scan at fixed frequency (Mott-Schottky type).



Electrochemical Impedance

Any type of Potentiostatic or Galvanostatic Electrochemical Impedance Spectroscopy experiment can be performed.

EIS analysis

Automatic R1R2C equivalent circuitry fitting is provided with a circular regression. The R1R2C conventional model for a simple electrochemical process is widely used to compare different samples or processes. EIS files can be transferred to Z-View for future analysis.

Potentiostatic Impedance

For kinetics, dynamic EIS (Impedance) being the fastest mode.

Galvanostatic Impedance

For corrosion and battery testing.

Mott-Schottky (Capacitance)

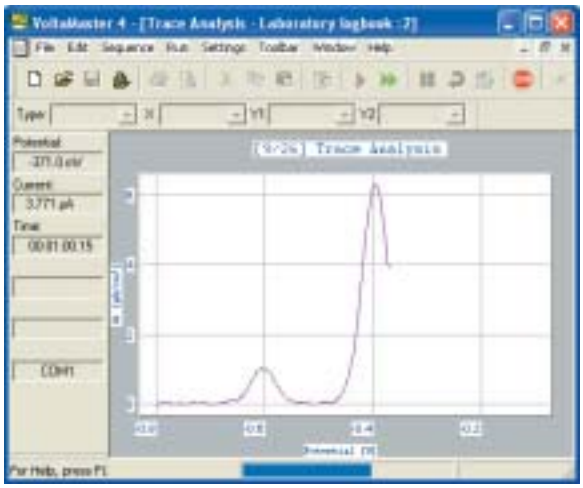
The Pot. Fixed Freq. EIS (Capacitance) method provides information about charge-transfer and adsorption mechanisms. The experimental file includes impedance data and the result of capacitance calculation plus DC potential and DC current. The voltammetry is recorded simultaneously along with the "Mott-Schottky" diagram.

EIS programming is made easy for

Frequency scan	**at a single DC potential**.
Frequency scan	**at a single DC current**.
Potential scan	**at fixed frequency** (Mott-Schottky experiment).
Frequency scans	**at specified time intervals** at a single DC potential or current.
Frequency scans	**at different DC potentials** from initial to final in preset potential steps.
Frequency scans	**at different DC currents** at different preset currents.
Frequency scans	**at specified time intervals at OCP** (in combination with OCP method) at a single DC potential or current.

Polarography

With VoltaLab 50/80



Square Wave Voltammetry

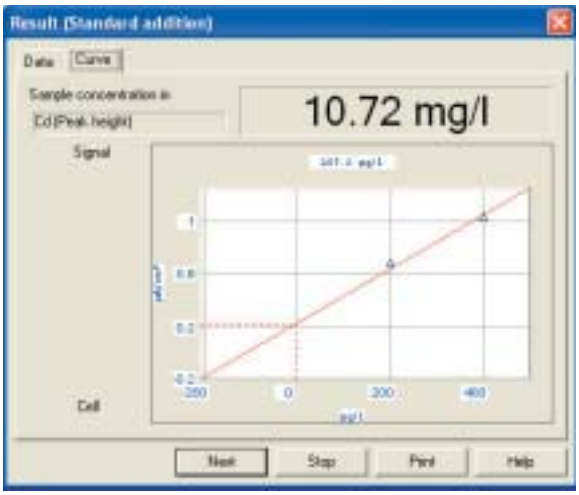
From Square Wave Voltammetry to Triple Normal Pulse Differential Voltammetry - every multipulse signal used in analytical electrochemistry can be programmed with VoltaLab.

Real-time plot

Run your experiment and observe the real-time display of the differential current. Interactivity means you can jump to the next method or stop it if necessary.

Experiment and calculation settings

Create a sequence to control the stand, perform the acquisition, automatically examine the peaks and print the results.



Calculations

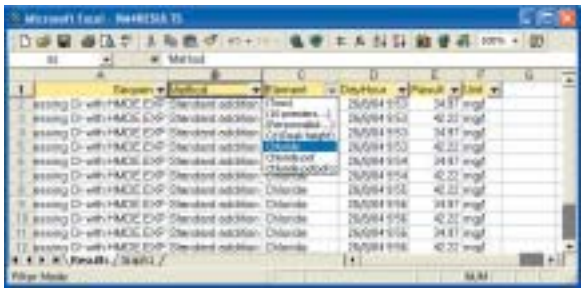
Each element is independently analysed. Smoothing and blank subtraction are available.

Post-run processing

You may wish to validate your choices step by step. Use “Differential Extraction” on the “raw data” curves to evaluate how you can improve the acquisition by adjusting the sampling window. Use “Subtraction/Addition” to remove the experimental blank from your sample curve. Use “Peak analysis” to examine your peak signals and adjust the settings used for quantitative analysis.

Printout

Date, time, sample identification, operator and supervisor names, regression factor and file identification for traceability purposes are printed in addition to the value itself.

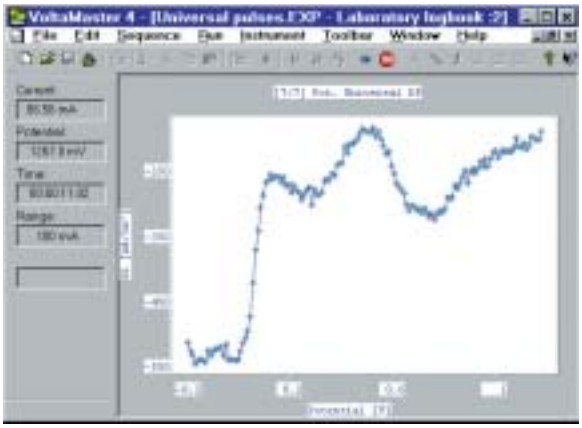


Database

When a new quantitative result is calculated, a VM4RESULTS.xls file is created/modified. VoltaMaster 4 saves the result in real mode (VoltaLab 50 and VoltaLab 80 only) and in virtual mode (every system). Anyone can review the behaviour of the data without entering VoltaMaster 4. Filters to sort the data from the database and graphs on additional pages can be requested within the VM4RESULTS.xls file.

Universal Differential Pulse

with VoltaLab 50/80



Real-time plot

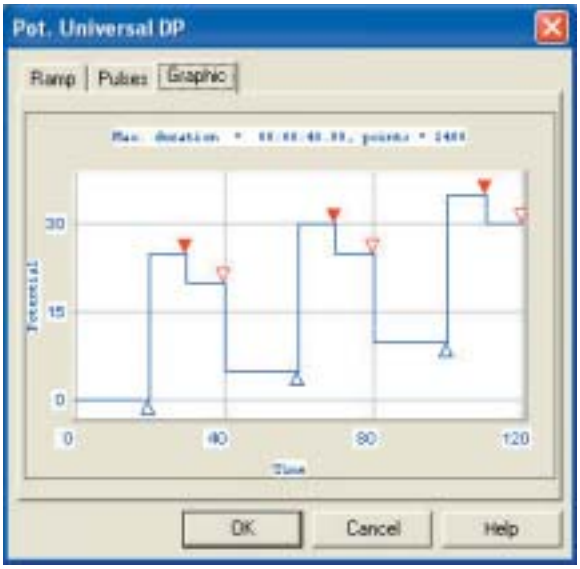
Run your experiment and observe the real-time display of the differential measurement versus potential or time. Intervene in order to jump to the next method or stop if necessary. If you refer to the graphic folder of the settings, the differential current measurement is taken between positions represented by the red inverted triangles and quoted versus the potential imposed at the position shown by the blue triangle.

Settings

Define a Ramp, add a multipulse signal with 8 levels on top and adjust the value and duration of each pulse individually. Click on Graphic to check the overall shape of the imposed signal. Universal Differential Pulse can be added in the sequence with any Method available, regulation can be maintained between methods with no gap! If in doubt, consult the Help file.

Universal Differential Pulse

It is so simple to prepare a universal multipulse experiment with the Pot. Universal Differential Pulse method that what you get is - amazingly - what you want!



Post-run processing

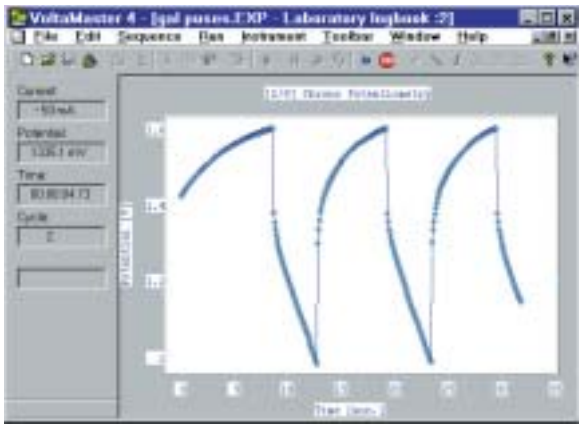
In addition to the differential file, a raw data file records the current during the whole experiment with a sampling rate equal to the acquisition period time, down to 500 µs. Post-run processing enables the user to recalculate any differential curve from the raw data, adjusting the “sampling window” and to extract any “Linear voltammetry” from it using the Linear extraction tool. Display them as you wish, extract the interesting parts, overlay curves, export them, calculate results.

Universal Differential Pulse

The principle is to define a combination of up to 8 levels of imposed potential (or current) versus time. Each step can last 255 times the acquisition period time (sampling rate). This sampling rate can be selected from 0.5 ms to 999s. RECURRENT, Linear SCAN and NORMAL modes are available. In normal mode, the applied set point is reset to an initial level to “regenerate” the interface between each pulse.

Battery testing

with VoltaLab 80/50

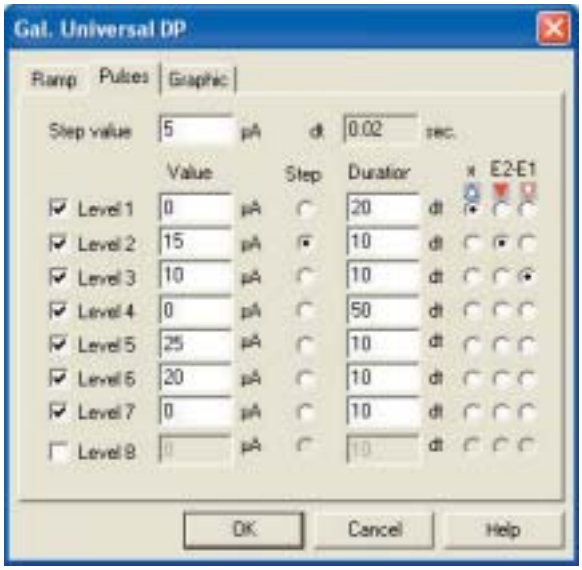


Gal. Recurrent Differential Pulse

To increase the performance of a battery, it is possible to charge it under various conditions.
A multilevel pulse galvanostatic signal optimises the charge. The Galvanostatic Recurrent Differential Pulse method is ideal for preparing experiments like this and combining them with galvanostatic experiments without opening the circuitry.

Real-time plot

Run your experiment and observe the real-time potential display. Intervene to jump to the next method or stop it if necessary.



Universal Differential Pulse

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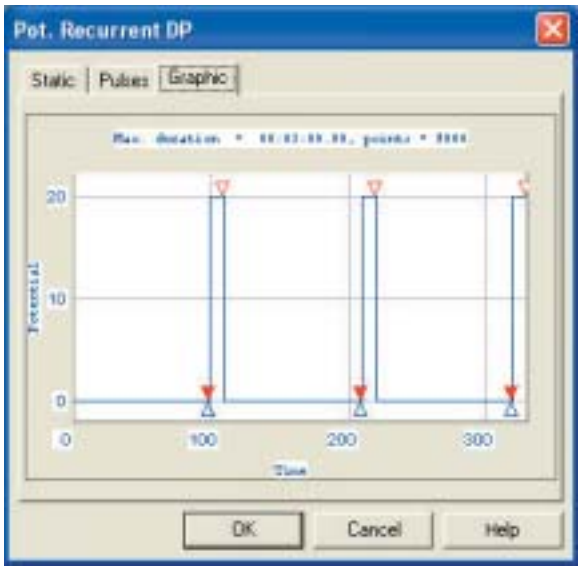


Settings

Define a maximum duration, set a potential limit and define a resolution time (equal to the shortest pulse you want to use) then build your multipulse signal with 8 levels and adjust the height and duration of each pulse individually. Click on the Graphic to verify the overall shape of the imposed signal. This method will charge the battery.

Sequence

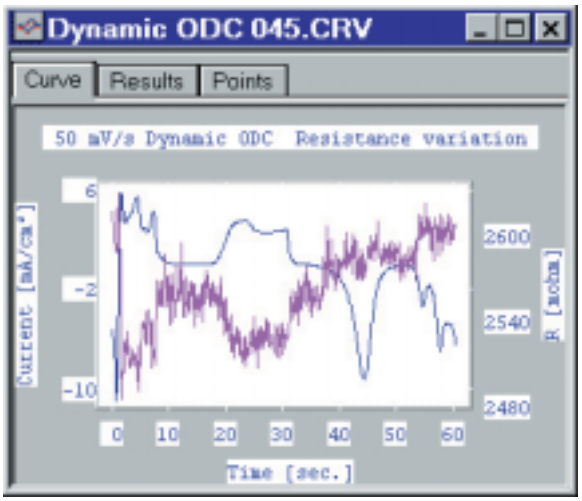
You can create a sequence of alternate charging and discharging. In addition, you may want to insert electrochemical impedance measurement at rest after each cycle. Nothing could be more simple.

Post-run processing

Post-run processing enables you to “Append” all the curves and filter them in order to reduce the number of points to a convenient number without losing information. This can be automated during the experiment.

DIDODC

with VoltaLab 40/80/50



Resistance monitoring

The cell resistance is measured, recorded and compensated step by step during the experiment. The variations in this resistance can form a new investigation method.

With or without compensation?

Many theories, especially in cyclic voltammetry, are only valid if the potential is driven linearly as a time function at the interface itself. Experimentally, the linearity is often not respected because of the Ohmic Drop and, as a consequence, relevant potentials are shifted. With Ohmic Drop compensation, the peaks are sharper.

Dynamic Impedance Driven ODC

is an innovative feature designed to compensate Ohmic Drop. During the experiment, the "cell-electrolyte" resistance is measured step by step by impedance. The OD is then calculated and the set potential for the next step automatically adjusted. The imposed potential compensates this OD. This active compensation is provided through algorithmic regulation without any risk of oscillations. Last but not least, this is a software-selectable option effective up to 100 mV/s with autoranging for current measurement.

Dynamic Impedance Driven Ohmic Drop Compensation

This unique feature is a selectable option within the relevant methods.

Simplicity

Prepare your Cyclic Voltammetry and select "Ohmic Drop compensation". It is that simple. What you get is - amazingly - what you want!

Static ODC

is based on an impedance measurement with an active compensation provided through algorithmic regulation. It is effective up to 1000 mV/s with autoranging for current measurement.

Feedback ODC

is available up to 20 V/s with automatic determination of the cell resistance by impedance.

Mathematical ODC

"Resistance subtraction" in post-run processing is also provided for DC measurements.

How ODC works

The Ohmic Drop is the product of the current which flows through the resistance of the electrolyte between the reference electrode and the electrochemically active interface of the working electrode. Due to the ohmic drop phenomenon, the potential at the interface is slightly different from the expected potential. Interface potential = (WORK-REF) potential - Ohmic Drop. The maximum resistance which can be compensated depends on the total current which flows through the electrochemical cell, on the polarisation voltage and on the compliance voltage.

VoltaMaster 4

Electrochemical Software

Monitor bar

The Monitor bar gives useful information between experiments. It displays the working electrode potential (in mV), plus the potentiostat status. As soon as an experiment starts, the Monitor bar is replaced by the Run bar

All-in-one

A single software to perform, analyse and document experiments in order to prepare your publications.

Cell setup

Use the cell setup to define your reference electrode and parameters useful for autocalculations, for instance in corrosion.

Multitasking

You can drive up to 8 VoltaLab potentiostats simultaneously from a single PC. You can examine files which have already been acquired while the experiment is still running.

Help

An illustrated Help section contains recommendations on how to prepare, run and examine experiments. A comprehensive set of demonstration curves and experimental method sequences is also available.

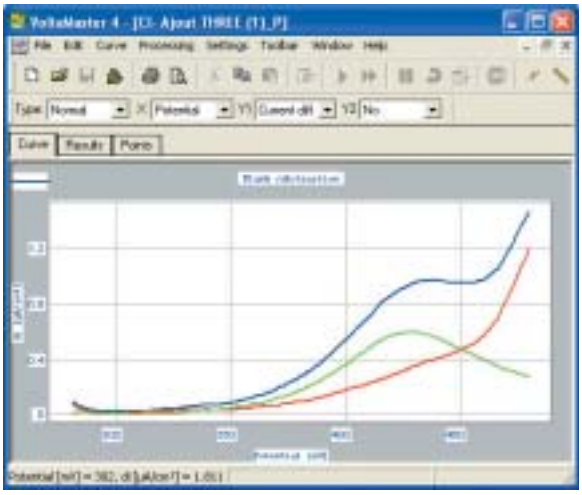
RCB200

The RCB200 Resistor Capacitor Box will help you become familiar with VoltaLab Electrochemical Laboratories and check their main technical specifications with “ready-to-use” sequences available in VoltaMaster 4.

Interactive real-time display

Real-time display is available at all times, even at maximum sampling rate. You can skip to the next method within the sequence, stop the experiment or modify any interactive setting.

Post-run processing



Post-run
Everything is ready for you to document your experiment and prepare your report.

Calculation routines
Peak analysis - Integration - Tafel analysis - Linear regression - Circular regression - R1R2C fitting for EIS - Stern analysis - Evans analysis - Coulometric dissolution - Resistance subtraction - Standard Addition - Standard Calibration - Sort by potential.

Export facility
This exports the curve as displayed in Excel in order to help you to transfer experimental data to other software. You can, for instance, transfer log (current) versus sqrt (time).

Result database
Every quantitative result is automatically recorded in an Excel database for optimum connection to LIMS systems.

"Intelligent filter"
Linear Extraction reduces your file size without losing any information. You can also apply offsets to quote your potentials versus SHE, for example. And it can be automated!

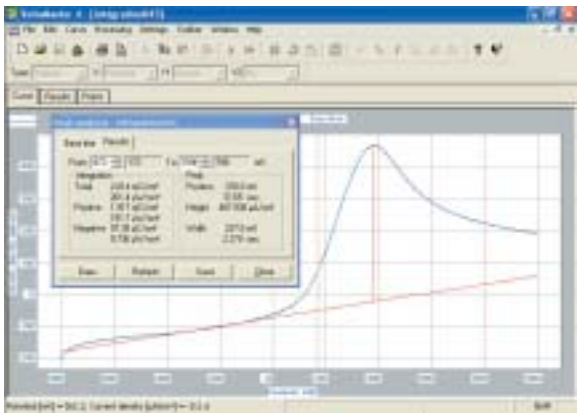
Curve operation
X Y1 Y2 representation - Zoom - Overlay/Remove - Linear extraction - Differential extraction - Potential reset/offset - Current reset/offset - Charge reset/offset - Time reset/offset - Curve addition/subtraction - Append - Export (to Excel 97 or higher) - Smoothing - Cursor - Title - Legend

Type bar
The type bar is the most versatile tool for representing your experimental curves. All parameters can be displayed.

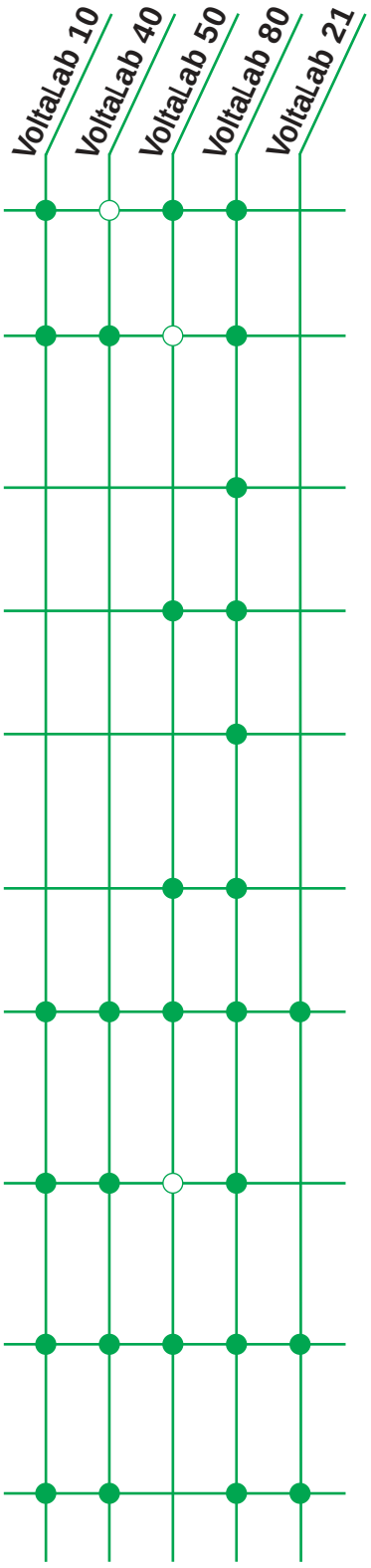
Curve save as
To give your most important files explicit names, independent from the sequence name.

"Results" folder
Each curve has a "Results" folder where you can attach comments and save the results of the calculations performed with the analysis tool. This information is saved and can be printed with the curve. Whenever you open a curve, the information you need is there.

Experimental curves in ASCII
They feature Potential, Current, Time, Resistance, Auxiliary, A/D IN, Frequency, Module, Phase, Zreal, -Zimaginary and Capacitance, depending on method settings. Any data from one file can be displayed (as Y1 or Y2) versus any other data from this file (as X) with mathematical functions to process X, Y1 and Y2 such as log, sqrt, inv.



Additional units



● *Recommended*

○ *Possible*

Additional units

Analytical rotating disc stand

To perform **quantitative analysis** with stripping cyclic voltammetry on a rotating disc electrode, the RDS010 is the obvious choice.

Voltage booster

The HVB100 High Voltage Booster boosts your VoltaLab system compliance voltage up to ±100 V. Useful in **organic electrochemistry** or when a very large ohmic drop needs to be compensated.

Current booster

HCB020: the ultimate choice for **fuel cell** investigations with galvanostatic expert EIS available under 20 A and current interrupt management.

Mercury drop electrode stand

To perform **stripping analysis** and pulse polarography, the MDE150 Polarographic Stand can be directly driven from VoltaMaster 4.

Potentiostats X,Y,Vg

VoltaLab 80 allows you to operate any of **your potentiostats** featuring potential and current analogue output plus signal generator input with the "X,Y,Vg" instrument setup selection.

External unit

Any type of external unit controlled by a RS232C (e.g. **microbalance**, burette, spectrometer) can be driven from VoltaMaster 4.

Quartz microbalance

We recommend the PM-710 from **Maxtek** with its DI-10 DAC interface.

Combinations

Bipotentiostat

To perform **Ring Disc Rotating Electrode** measurements, for example, use two VoltaLab systems simultaneously. The WE1 and the WE2 currents are saved in the same file thanks to the A/D IN channel for easy interpretation of your results.

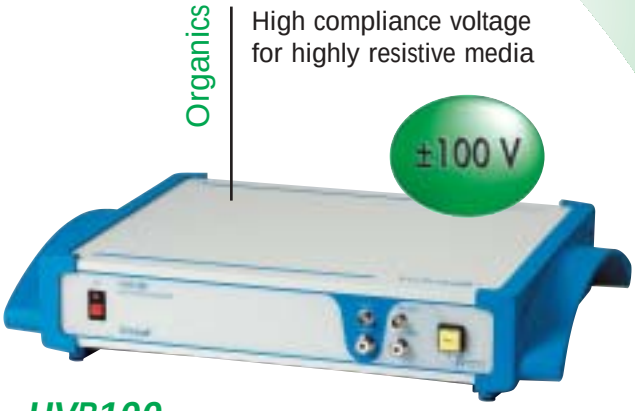
Multipotentiostat

You can drive up to 8 potentiostats independently and **simultaneously** from one PC (USB/RS232 required) with VoltaMaster 4.

External signal generator

An external analogue signal generator can be used for instance to impose **high scan rates** or a special wave form.

High voltage booster



The HVB100 boosts your compliance voltage up to ±100 V. Connect the HVB100 to your PGZxxx or PST050 Potentiostat and declare it in the VoltaMaster 4 setup. Every method is still available. This additional unit is useful in **organic** electrochemistry or when a very large ohmic drop needs to be compensated. Compatible with VoltaLab 10, VoltaLab 40, VoltaLab 50 and VoltaLab 80.

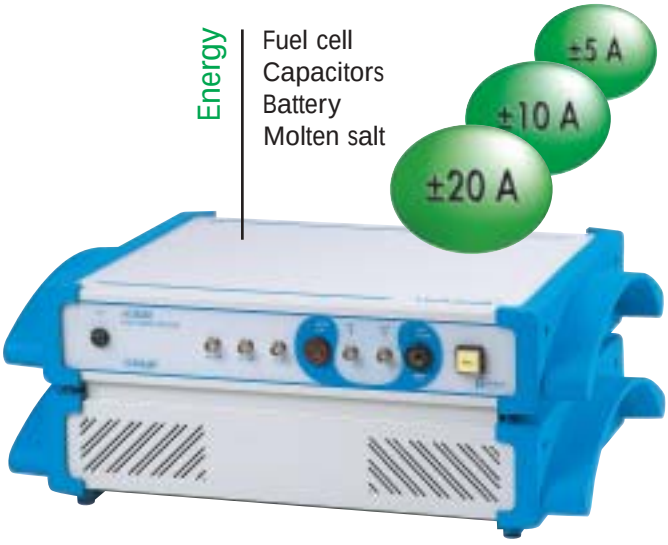
HVB100

High Voltage Booster

Ordering information

HVB100 (230 V)	R21V013
HVB100 (115 V)	R21V014

High current boosters

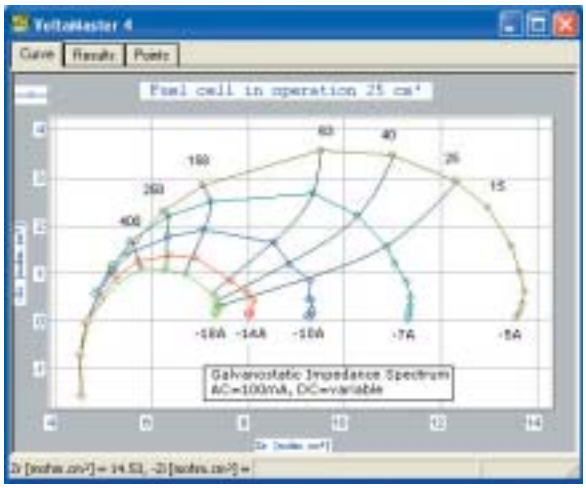


HCB020

High Current Booster

Ordering information

HCB005 (230 V)	R21V031
HCB005 (115 V)	R21V032
HCB010 (230 V)	R21V029
HCB010 (115 V)	R21V030
HCB020 (230 V)	R21V027
HCB020 (115 V)	R21V028



VoltaLab offers you three models, the HCB005, HCB010 and HCB020 which deliver up to 5, 10 and 20 A respectively. Each model offers 2, 3 or 4-pole connections in galvanostatic as well as in potentiometric mode. Time resolution is available down to 0.5 ms. They are driven by a PGZ402 (VoltaLab 80) and capable of Electrochemical Impedance measurement. Either WORK or AUX can be grounded. They are ideal for fuel cell and energy storage component tests.

Rotating Disc Electrode Stand

The RDS010 Analytical Rotating Disc Stand stays safely in place whenever you have to handle your sample. It accommodates a Rotating Disc Electrode and solid electrodes very easily in its 4 holes (14.5/23 sleeves). The rotation speed of the RDE is driven from VoltaMaster 4 with VoltaLab 10/40/50/80. Ideal for setting up a routine analytical stand using a rotating disc electrode, this stand is also suitable for teaching. The RDS010 offers precise and fully reproducible experimental conditions day after day.

The RDS010-Co comes with one Rotating Disc Electrode with a platinum disc tip (diameter = 5 mm), an Ag/AgCl reference electrode and its double liquid junction protective tube plus a platinum wire counter electrode and a set of beakers and cables. The RDS010-Ba is delivered without any electrodes.

RDS010

Analytical Rotating Disc Stand

Rotation speed

Adjustment from VoltaMaster 4	100 to 5000 rpm
Accuracy on rpm	±0.1%
External control (BNC)	0-5 V full scale
Connection to the potentiostat	BNC

General

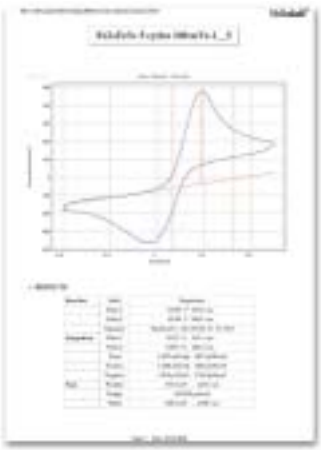
Power supply	115/230 Vac + 15-18%
	47.5-63 Hz
Size & Weight	34 x 20 x 26 cm & 6.5 kg

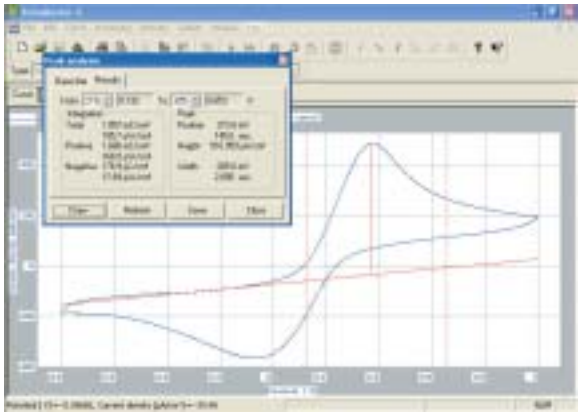
Ordering information

RDS010-Co (230 V)	R21V021
RDS010-Co (115 V)	R21V022
RDS010-Ba (230 V)	R21V019
RDS010-Ba (115 V)	R21V020

Accessories for Nitrogen bubbling

50 beakers with cover (polypropylene, 180 ml)	X31V005
BA-Nitrogen bubbler	A30T460
RA/CPRA-Stopcock for nitrogen inlet	A30T400
ES/46-Silicon tubing (2 m) int. diameter 4 mm	A25X330





Polarographic Stand

The MDE150 Polarographic Stand accommodates either the MDE/HGDROP Hanging Mercury Drop Electrode or the EDI101 Rotating Disc Electrode driven from a separate CTV101 Speed Control Unit. Nitrogen humidifier vessels prevent reduction of the sample volume due to evaporation. The glass sample cell (volume = 5 ml) fits in place without any risk of the geometry of the electrodes being modified. Full automation is controlled from VoltaMaster 4 with either VoltaLab 50 or VoltaLab 80 regarding hammer stoke, mercury drop size (growth time), stirring, purging and blanketing.

MDE150
Polarographic Stand

General

Connection to the potentiostat	DINLOCK6
Power supply	115/230 Vac + 15-18%
	47.5-63 Hz
Size & Weight	34 x 20 x 26 cm & 6.5 kg

Consumables

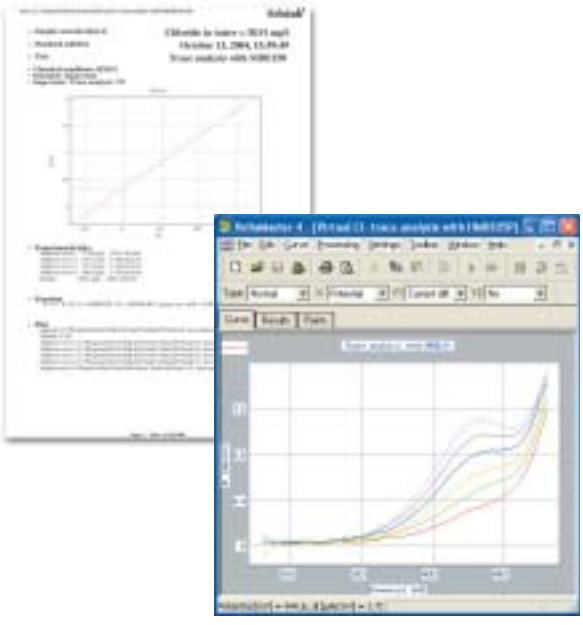
TM020 Platinum electrode	B18C002
TR020 Ag/AgCl Reference Electrode	B18C003
EGM/AL010 Ionic-bridge for reference electrode	A30T085
Filling solution for reference electrode, 30 ml	B22D004
CP020 Polarographic cell, Standard, for MDE150	B22D001
Adapter support for EDI/MDE150	A67A003

Ordering information

MDE150, 230 V	A31A003
MDE150, 115 V	A31A004

In addition to the MDE150, the following kits are needed to obtain a HMDE.

MDE/HGDROP Mercury Drop Electrode Kit	A31K003
MDE/EL Reference and Counter Electrode Kit	A31K002
MDE/SET Setup Accessory Kit	A31K001
C505R DINLOCK6-M/1m/2PL259-BNC cable	A95R505



How to select a stand

You need a mercury drop electrode: MDE150. You need remote control degassing: MDE150. If you work on solid state electrodes and you can handle the degassing manually: RDS010 using the RDE as a very accurate stirrer or as the working electrode by itself.

Trace analysis

VoltaLab 50 is an analytical instrument designed to automate and simplify electrochemical analysis. When used in conjunction with the MDE150 Polarographic Stand or the RDS010 Rotating Disc Stand, it becomes an efficient analytical station with outstanding capabilities in terms of performance (powerful supervisor level) and ease of use (secure operator level for routine analysis).

Calculation

You can calculate from Peak magnitudes, Peak positions and Peak surfaces. This means that even if the peak is rather weak, you can still perform calculations. This is often the case when the blank does not generate a well-defined peak. Standard addition, calibration by addition and standard calibration methods are available.

Blank

You can choose whether to take the blank into account for the calculations. As a rule, the blank is used when the signal at no concentration is large compared to the signal at maximum concentration.

Dilution factors

Dilution factors are taken in account so that you get the results for your sample in addition to your "cell" result.

Selectable unit

You can select your own unit and a factor in order to get a figure which makes sense in your analytical context.

Calibration "curves"

The full spectrums are recorded. In post-run processing, you can decide to recalculate versus the integration of the peak rather than the peak magnitude. You will use the same set of spectrums.

"Curve" or "method"

The calculation method concerns either a method within the sequence or a file on your hard disk. This enables you to create a sequence which generates the calibration "spectrums" independently from the sequence used to run your sample.

Database

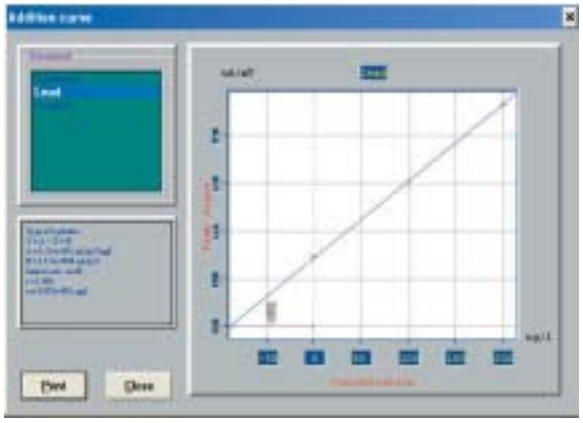
A VM4RESULTS.xls file is automatically created/modified whenever a quantitative result is calculated from VoltaMaster 4.

		Voltammetric Trace Analysis									
		EIS	Polarography	CP	CA	CV	CVS	SQWV (pulses)	CCSA	PSA	Max current
Mercury Drop Electrode	TraceLab 50		•		•	•		•			10 mA
	VoltaLab 80 + MDE150 + MDE/HGDROP + MDE/EL + MDE/SET+ C505R	•	•	•	•	•	•	•	•	•	1000 mA
	VoltaLab 50 + MDE150 + MDE/HGDROP + MDE/E + MDE/SET+ C505R		•	•	•	•	•	•	•	•	1000 mA
Rotating Disc Electrode	VoltaLab 50 + RDS010-Co			•	•	•	•	•	•	•	1000 mA
	VoltaLab 80 + RDS010-Co	•		•	•	•	•	•	•	•	1000 mA

Polarography

TraceLab 50
Polarographic Laboratory

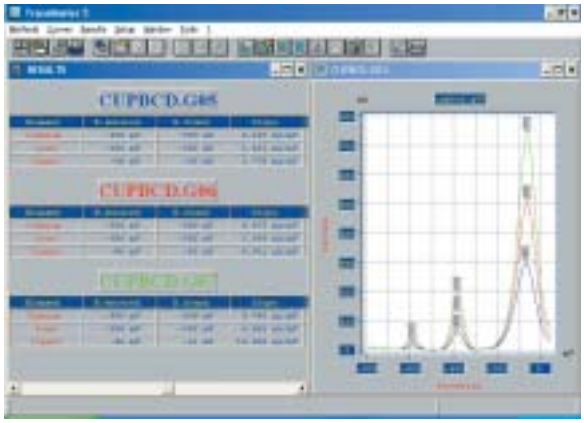
TraceLab 50 is the ideal system for research laboratories performing quantitative analyses of heavy metals and organic compounds at trace level. It consists of the POL150 Polarographic Analyser and MDE150 Polarographic Stand controlled by TraceMaster 5 Software. TraceMaster 5 Software handles the MDE150 and automates standard addition, calibration by addition and standard calibration as well as peak auto recognition. Operations such as hammer stoke, mercury drop size (growth time), stirring, purging and blanketing are all controlled from the PC via TraceMaster 5.



Detailed application notes are available from the TraceLab Resource Centre at
www.radiometer-analytical.com

Ordering information

TraceLab 50 (230V)	A31A007
TraceLab 50 (115V)	A31A008



The TraceLab range, which has applications in the food and beverage industry, environment and water, chemical and pharmaceutical research, consists of polarographic analysers for the determination of heavy metals and organics at trace levels.

Rotating Disc Electrodes

Up to 5000 rpm

EDI101

The EDI101 is a versatile and rugged rotating disc electrode ideal for use with any potentiostat/galvanostat. Precise mechanical design ensures an eccentricity of less than ±0.1 mm for rotation speeds from 100 rpm to maximum. An inert gas inlet is provided to protect the ball bearings in harsh operating conditions, extending electrode life. It is available with a wide choice of quick-fit exchangeable tips in various materials: platinum, glassy carbon, gold etc.

Sleeve to fit BEC/EDI cell	14.5/23
Eccentricity (100-5000 rpm)	< ±1 mm

Accessories

RDS010	EDI101 Stand (see p. 27)
BEC/EDI	Basic Electrochemical Cell (see p. 34)

Ordering information

EDI101	A35T040
CTV101 (230 V)	A35T050
CTV101 (115 V)	A35T055

Up to 10000 rpm

EAD10000 and EDI10000

The EAD10000 is a rotating Ring & Disc electrode (Pt/Pt). The EDI1000 is a rotating disc electrode with interchangeable tips. Both electrodes have an eccentricity of less than 1 mm.

Interchangeable tips

A wide choice of quick-fit exchangeable tips in standard or custom materials: platinum, glassy carbon, gold etc. is available to fit the EDI Rotating Disc Electrodes.

Standard (l = 40 mm)

Platinum ø5 mm	A35T452
Gold ø4 mm	A35T456

Standard (l = 20 mm)

Glassy Carbon ø3 mm	A35T090
Gold ø2 mm	A35T110
Gold ø5 mm	A35T120
Platinum ø2 mm	A35T100
Platinum ø5 mm	A35T105
Silver ø5 mm	A35T150
Stainless steel ø5 mm	A35T420

Without material

Sample holder tip	A35T450
Tip without hole	A35T402

Speed control units

for rotating disc electrodes

CTV101

Speed Control Unit for EDI101

The speed control unit controls the RDE rotation speed. It offers accuracy better than ±0.1% for precise and fully reproducible experimental conditions. The measured rotation speed is clearly displayed on a four-digit LCD. The speed control unit can be directly driven from VoltaLab 10, VoltaLab 50, VoltaLab 40 and VoltaLab 80. You can program the variation of the rotation speed from one method to another method and achieve a “Levitch” type experiment all in one go.

Display for rotation speed in rpm	LCD
Manual control	100 to 5000 rpm
Accuracy on rpm	±0.1%
External control (2 banana)	0-5 V full scale

TACHYPROCESSEUR

Speed Control Unit for EDI10000

The speed control unit controls the rotation speed. It offers precise and fully reproducible experimental conditions.

Display for rotation speed in rpm	4 digit LED
Manual control	100 to 10000 rpm
PC External control	SUB-D9 male
External control (2 banana)	0-5 V full scale
Accuracy on rpm	±0.1%

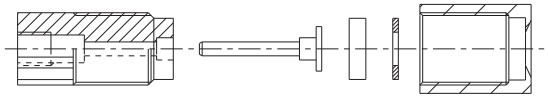
Accessories

XLRC	200 ml thermostated cell for EDI/EAD
S/EAD10000	Stand for EDI/EAD

Ordering information

Tachyprocesseur (230 V)	A35A300
Tachyprocesseur (115 V)	A35A310
EAD10000 (Pt/Pt)	A35A290
EDI10000	A35T060

The Sample holder tip is designed to enable the user to insert his own sample. A typical example would be a chemical deposit on the surface of a metal plate.



Sample holder tip

The tip without hole is designed to allow the use of the rotating disc electrode (EDI) as a very precise stirrer.

Available on special order (l = 20 mm)

Antimony ø5 mm	A35T310
Cadmium ø5 mm	A35T210
Copper ø5 mm	A35T130
Graphite ø4 mm	A35T140
Iron ø5 mm	A35T200
Lead ø5 mm	A35T300
Nickel ø5 mm	A35T160
Tin ø5 mm	A35T170
Titanium ø3 mm	A35T190
Tungsten ø1 mm	A35T320
Zinc ø5 mm	A35T080

Electrodes

A large selection

of reference and metal electrodes is available together with cables and adapters as well as liquid junction protecting tubes with ceramic junction.

Ask for our electrode catalogue, part no. **D11M046**
'Guide to Reliable pH, Ion and Conductivity Measurements'

Platinum

Wire	B35M110
Plate	B35M140
Disc	B35M150
Micro disc 10 µm	B35A978

Gold

Microdisc 60 µm	B35A999

Reference

Calomel	B20B110
Hg/Hg2SO4	B20B200
Hg/HgO	B20B400
Ag/AgCl	B20B300

Liquid Junction Protection Tubes

Ceramic rod	B40A610
Reversed sleeve	B40A710

Flow cell

C145/170

You can circulate a liquid through the cell. The sample holder is designed for disc samples.

- Volume = 250 ml
- KEL-F sample holder
  Disc diameter 1.4 cm
  Disc active area 0.95 cm^2
- One platinum disc counter electrode
- One calomel reference electrode
- Luggin capillary
- One flow-through inlet/outlet

Part Number A50T110

Data sheet D11V013*

ASTM cell

CNC

This **ASTM standard cell** supports cylindrical samples for corrosion tests.

- Volume = 1000 ml
- Two counter electrodes (platinum cylinders)
- One calomel reference electrode
- Adjustable Luggin capillary
- One thermometer
- One stainless steel sample
- One gas bubbler

Part Number A50T400

Data sheet D11V012*

Cells

The right cell for your application

A wide choice

VoltaLab offers a range of cells intended for the study of corrosion phenomena. All cells are fitted with gas inlet and Luggin capillary and delivered with one reference and one counter electrode. Working and counter electrodes are located opposite each other to ensure good distribution of electrical fields. Radiometer Analytical cells can be assembled quickly and easily. For measurements at high temperatures, special thermostated cells are available. Ask for an **individual data sheet**.

Pyrex

Cells are made of Pyrex glass which has the following composition:
SiO_2 80%; B_2O_3 13%; Al_2O_3 2.25%
Fe_2O_3 0.05%; Na_2O 3.5%; K_2O 1.15%

Basic cell

BEC / EDI

Ideal for **teaching**.
Delivered with a bubbler, one calomel reference electrode and a platinum counter electrode, the BEC / EDI cell is suitable for use with rotating disc or solid electrodes.

- Volume = 20 to 50 ml
- Thermostated
- One Pt counter electrode (wire)
- One Calomel reference electrode
- 5 holes - Sleeves 14.5 / 23
- One bubbler
- Suitable for Rotating Disc Electrode

Part Number X51V001

Data sheet D11V015*

Disc samples

CEC / TH

Thermostated cell for corrosion with sample holder for discs and platinum disc counter electrode. Two optional sample holders are available for **coupled corrosion** testing.

- Volume = 100 to 200 ml
- Thermostated
- KEL-F sample holder
- For disc sample
  Disc diameter 1.4 cm
  Disc active area 0.95 cm^2
- One Pt disc counter electrode
- One calomel reference electrode
- Luggin capillary
- One thermometer
- One gas inlet / outlet

Part Number
B70A050

Data sheet D11V011*

Flat samples

CCTO

Ideal for **under coating corrosion** tests. Corrosion cell for flat samples with a large surface.

- Volume = 100 to 200 ml
- Thermostated
- Sample active area 30 cm^2
- One stainless steel disc counter electrode
- One calomel reference electrode
- Luggin capillary
- One thermometer
- One gas inlet / outlet

Part Number A50T950

CCTO / TH

Thermostated CCTO cell
Part Number A50T960

Data sheet D11V014*

*Data sheets are available from our website in PDF format.

Leading the field in electrochemistry

Radiometer Analytical SAS develops, manufactures and distributes an extensive range of electrochemical systems dedicated for routine testing, research and teaching in the laboratory and on the plant.

By supplying instruments, software, sensors and calibration standards, Radiometer Analytical SAS masters the complete measuring chain. Our customers obtain a reliable result at reasonable cost thanks to all-in systems that are easy to use and maintain.

The company enjoys a reputation for excellence in the following fields:

pH, ion and conductivity measurements: complete systems for reliable measurements in the field and in the lab including a wide choice of instruments, sensors and standards.

Titration: workstations customised to individual applications including titrators, sample changers and dedicated software.

Voltammetry: all-in systems for electrochemical measurements including potentiostats, impedance meters and powerful software making use of techniques such as voltammetry, amperometry, coulometry, polarography and EIS.

Radiometer Analytical SAS has been building its expertise for more than sixty years since the company pioneered its very first pH meter in Copenhagen, Denmark. It was strengthened by the acquisition of Tacussel, another leading name in electrochemical instrumentation. More recently Radiometer Analytical SAS joined the Danaher Corporation.

Based in Lyon, France, Radiometer Analytical SAS is represented throughout the world by a network of experienced, factory-trained distributors, who can offer comprehensive applications and after-sales service.

Radiometer Analytical SAS is ISO 9001 certified. In addition, our Reference Materials Laboratory is accredited by COFRAC (Comité Français d'Accréditation) for the calibration of reference materials in pH and conductivity (Accreditation No. 2.1418).

Un grand savoir-faire en électrochimie

Radiometer Analytical SAS conçoit, fabrique et distribue une gamme complète d'ensembles électrochimiques de laboratoire et de terrain dédiés à l'analyse de routine, la recherche et l'enseignement.

En fournissant à ses utilisateurs des instruments de mesure, logiciels, capteurs et solutions d'étalonnage, Radiometer Analytical SAS maîtrise l'ensemble de la chaîne de mesure. Cela garantit des résultats fiables avec des ensembles complets et faciles à utiliser et entretenir, à un coût raisonnable.

Notre société a acquis une solide réputation grâce à son savoir-faire dans les domaines suivants :

pH-métrie, ionométrie et conductimétrie : des ensembles complets pour des mesures fiables en laboratoire ou sur le terrain comprenant un large choix d'instruments, de capteurs et de solutions étalons.

Titrage : des stations de travail adaptées en fonction de chaque type d'application incluant des titrateurs, des passeurs d'échantillons et un logiciel spécifique.

Voltamétrie : des systèmes "tout-en-un" pour effectuer des mesures électrochimiques, comprenant des potentiostats, des impédancemètres et un logiciel puissant, et permettant l'utilisation de techniques telles que la voltamétrie, l'ampérométrie, la coulométrie, la polarographie et l'EIS.

Depuis la fabrication de son premier pH-mètre à Copenhague il y a plus de soixante ans, Radiometer Analytical SAS a constamment développé sa maîtrise et son expertise dans le domaine de l'électrochimie et a renforcé sa réputation par l'acquisition de Tacussel, une autre marque leader dans l'instrumentation électrochimique. Plus récemment, Radiometer Analytical SAS a rejoint le groupe Danaher Corporation.

Basée à Villeurbanne (Rhône), Radiometer Analytical SAS est représentée par un vaste réseau de distributeurs en France et dans le monde, qui peuvent répondre rapidement à toutes les demandes commerciales, techniques, applicatives et de service après-vente.

Radiometer Analytical SAS est certifiée ISO 9001. De plus, notre Laboratoire Matériaux de Référence est accrédité par le COFRAC (Comité Français d'Accréditation) pour l'étalonnage de matériaux de référence pour les mesures de pH et de conductivité (Accréditation N° 2.1418).

Führend auf dem Gebiet der Elektrochemie

Radiometer Analytical SAS entwickelt, fertigt und vertreibt ein umfangreiches Programm elektrochemischer Laboranalysensysteme, die für Routineprozesse genauso geeignet sind, wie für Ausbildung und Forschung.

Radiometer Analytical SAS bietet komplette Lösungen.
Diese sind speziell den Kundenanforderungen angepasst und gewährleisten in der täglichen Routine einfache Handhabung, hohe Sicherheit und zuverlässige Analysenergebnisse.

Die Firma verfügt insbesondere auf folgenden Gebieten über einen hervorragenden Ruf:

pH-, Ionen- und Leitfähigkeitsmessungen: MeterLab sind komplette Messplätze für zuverlässige Analysen im Feld und im Labor, mit einem breiten Angebot von Instrumenten, Sensoren und Standards.

Titration: TitraLab sind leistungsfähige Titrationsautomaten, die den individuellen Anforderungen angepasst werden können. Endpunkt-, Wendepunkt-, pH-stat- oder Karl Fischer- Titratoren, ausgestattet mit modernster Technik, stehen zur Verfügung. Softwaregesteuert lassen sich diese Titratoren kombinieren oder durch Zusatzbüretten und einem Probenwechsler weiter ausbauen.

Elektrochemische Messsysteme: VoltaLab sind Komplettsysteme, die allen Anforderungen gerecht werden. Alle Potentiostate der VoltaLab- Serie werden über die gleiche Software gesteuert. Elektrochemischen Methoden wie Voltammetrie, Amperometrie, Coulometrie oder EIS- Impedanzmessungen können auf diese Weise sinnvoll verknüpft werden.

Radiometer Analytical SAS profitiert von seinen im Verlauf von über 60 Jahren erworbenen Erfahrungen. Am Anfang stand der Bau eines bahnbrechenden pH-Meters in Kopenhagen. Die Position der Firma wurde durch den Erwerb von Tacussel, einer bekannten Firma auf dem Gebiet der Elektrochemie, weiter gestärkt. In jüngster Zeit schloss sich Radiometer Analytical SAS der Danaher Corporation an.

Die von Lyon aus operierende Firma Radiometer Analytical SAS wird weltweit durch ein Netz erfahrener, im Werk ausgebildeter Fachkräfte vertreten, die vor Ort bei Anwendungen und Kundendienst umfangreiche Unterstützung gewähren können.

Approved Quality System

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