ZAHNER ZENNIUM
electrochemical workstation

The Modular System

External Potentiostats and Electronic Loads

... enhance the output up to
±120 Volts
±40 Ampere
300 Watt
64 Channels

Probes

... prepare the Zennium for special fields of application like high impedances, electrochemical noise, etc. and interface with 3rd-party devices (electronic loads, potentiostats, ...)

4 Extension Card Slots

... expand your Zennium optionally with various plug & play cards according to your needs and future tasks.

Batteries
Fuel Cells
Coatings
Corrosion
Solar Cells
Sensors
Super Caps

Specifications

General

Overall Bandwidth		DC - 5 MHz
ADC Resolution		18 bit
Harmonic Reject		> 60 dB @ ½ full scale
Potentiostat Modes		Potentiostatic, galvanostatic, pseudo-galvanostatic, rest potential, off
Cell Connection		2-, 3-, 4-terminal Kelvin
Chassis		ground
Extension Slots		4
PC interface		USB 1.1 / 2.0
Dimensions		364 x 160 x 376 mm
Weight		12 kg
Accessories		U-buffer, 2 cell cable set, USB-cable, power cord, manual
Power supply		230/115 V, 50/60 Hz
Ambient temperature		+10° C to +30° C
Ambient Humidity		< 60% without derating

Frequency Generator & Analyzer

Frequency Range		10 µHz to 4 MHz
Accuracy		< 0.0025%
Resolution		0.0025%, 10.000 steps/decade

Output Potentiostatic

Controlled Voltage	Pot	±4 V
	U-buffer	±10 V
Resolution	Pot	125 µV
	U-buffer	320 µV
Accuracy	Pot	±250 µV
	U-buffer	±1 mV
Temperature Stability		better 20 µV/°C
Compliance Voltage	Pot	±14 V
	CVB120	±120 V
AC-Amplitude		1 mV to 1 V
Bandwidth		4 MHz @ 33 Ω load
IR Compensation	Method	Auto AC Impedance Technique
	Range	0 to 10 MΩ
	Resolution	0.012%
Small Signal Rise Time		250 ns to 200 µs in 5 steps, automatic selection
Slew Rate		15 MV/s
Phase Shift		10 deg @ 250 kHz

Output Galvanostatic

Controlled current		±2.5 A
Current Range	Pot	±100 nA to ±2.5 A in 8 steps
	HiZ	±1 nA to ±0.5 A in 10 steps
Min. Resolution		0.025%
Accuracy		0.1% @ > 2 µA to 100 mA
		1% @ < 2 µA or > 100 mA

Input

Potential Ranges	Pot	±1, ±2, ±4 V
	U-buffer	±4, ±10 V
Potential Resolution		256.000 steps per range
Offset Voltage		< 100 µV
Offset Temperature Stability		< 20 µV/°C
Current Range	Pot	±100 nA to ± 2.5 A in 24 steps, automatic range selection
	HiZ	±1 nA to ±0.5 A in 26 steps, automatic range selection
Accuracy		0.05% @ > 2 µA to 100 mA
		0.5% @ < 2 µA or > 100 mA
Input Bias Current	Pot	10 pA
	HiZ	12 fA
Current Resolution	Pot	2.5 pA
	HiZ	25 fA
Input Impedance	Pot	1 TΩ // ±5 pF (typical), 50 GΩ // ±5 pF (min.)
	HiZ	10 TΩ // ±1 pF (typical), 1 TΩ // ±1 pF (min.)
Impedance Range	Pot	1 mΩ to 1 GΩ / 2%
		100 mΩ to 10 MΩ / 0.2%
	HiZ	100 mΩ to 100 GΩ / 3%
	Gal	30 µΩ to 1 GΩ / 2%
Common Mode Rejection		> 86 dB @ 10 µHz to 100 kHz
		> 66 dB @ 100 kHz to 4 MHz
Input Channel Phase-Tracking accuracy		±0.1 deg @ 10 µHz to 100 kHz
		±0.25 deg @ 100 kHz to 4 MHz
Equiv. Effective Input Noise		20 µV rms / 2 pA rms @ 1 mHz to 10 Hz

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MESSSYSTEME

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electrochemical workstation

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HIGHEND DATA ACQUISITION SYSTEMS

ZAHNER ZENNIUM

Milestones In Scientific Instrumentation

Universal Electrochemical Workstation

General

Our R&D team managed to create a completely new instrument with outstanding features, state-of-the-art hardware and a widely extended software as an advancement of the world-valued IM6eX. The result is a milestone in scientific instrumentation. ZENNIUM was developed using our 30 years of experience in producing high-precision electrochemical workstations of the high-end class. It provides a wider frequency range up to 4 MHz, an output current up to ±2.5 A and fast signal processing. Special measurement techniques guarantee an ultra high accuracy and a minimal interference with the test object.

ZENNIUM comes bundled with the outstanding Thales Z (zennium release) software package which offers all standard methods and more at a mouse click. This is why the ZENNIUM can easily be adapted to very different measurement requirements. Furthermore, with the manifold options available, the ZENNIUM is able to grow with its tasks. It is best suited for investigations on fuel cells, batteries and solar cells as well as on membranes and sensors or on coatings and laminates to name only a few.

ZAHNER-elektrik is known to provide competent service all around the world. Our experienced specialists help you to plan, set up and analyze your experiments in electrochemistry, physics, material science and electronics.

Option	*Function*	*ext*	*int*	*EPC42 needed*
TEMP/U	2 inputs for thermocouples + 2 voltage inputs		X	
DA4	4 analog outputs		X	
RMux	Relay multiplexer for the internal potentiostat		X	
PwrMux	Power multiplexer for the PP series potentiostats	X	X	
TR8M	Transient recorder up to 40 MHz		X	
HiZ probe	High impedance probe set	X		
LoZ	Cable set for low impedances	X		
EPC42	Control module for up to 4 external potentiostats		X	
XPot	External standard potentiostat	X		X
PP series	External power potentiostats	X		X
EL series	External high current one quadrant potentiostats	X		X
NProbe	Probe set for measuring electrochemical noise	X		X
COLT	Set-up for coating and laminate testing			
CIMPS	Set-up for photo electrochemical applications	X		X
ElChem Cells	KMZ and AMZ type cells for various applications			

Hardware

General

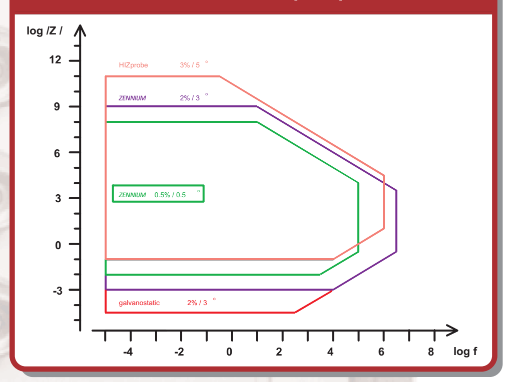
The hardware of the ZENNIUM provides

- ultra low-noise potentiostat
- wide frequency range dual DDS FRA
- high CMRR precision U/I-amplifiers
- PulSAR® state-of-the-art differential 18 bit ADCs for AC
- connectors optimized for High Z & Low Z
- 4 extension card slots
- 410 MIPS (Dhrystone 2.1) V4e ColdFire® signal processor
- floating USB interface

Accuracy

The highest priorities for the development and production of the ZENNIUM instruments are accuracy and reliability. The accuracy map of the ZENNIUM clearly shows the high quality of the hardware. These specifications are real ones relevant to the use in practice, based on the high-end components we use.

ZENNIUM accuracy map



PulSAR® is a registered trademark of Analog Devices, Inc.
ColdFire® is a registered trademark of Motorola, Inc.

Software

The powerful Thales software package is part of the standard equipment of each IM6 and ZENNIUM system. It provides a multitude of measuring and analysis methods.

The Thales software provides unique features for the acquisition and analysis. The most prominent examples are SCRIPT and SIM. SCRIPT offers you to combine all types of electrochemical measurements, mathematical analysis, algorithms, documentation and data export to a reproducible, fully automatic process. With the outstanding features of SIM you are able to create equivalent circuits and fit the measurement data to these models. The ZHIT feature of SIM helps you to validate your impedance spectra.

For evaluation only it is also possible to run Thales software package on a ThalesBox. The ThalesBox provides a single user licence of Thales. So you can process your recorded data on a simple PC or Laptop while your tests still run on the IM6 or ZENNIUM ...

- System requirements: IBM compatible PC, Microsoft® Windows® operating system (Windows® XP / Windows Vista®) and USB 1.1/2.0. Tested with Windows® 7 beta.

Based on the approved Thales software package, we extended the functionality, improved the supported methods and brushed up the look and feel.

All these innovations join in Thales Z (zennium release).

General fields of application

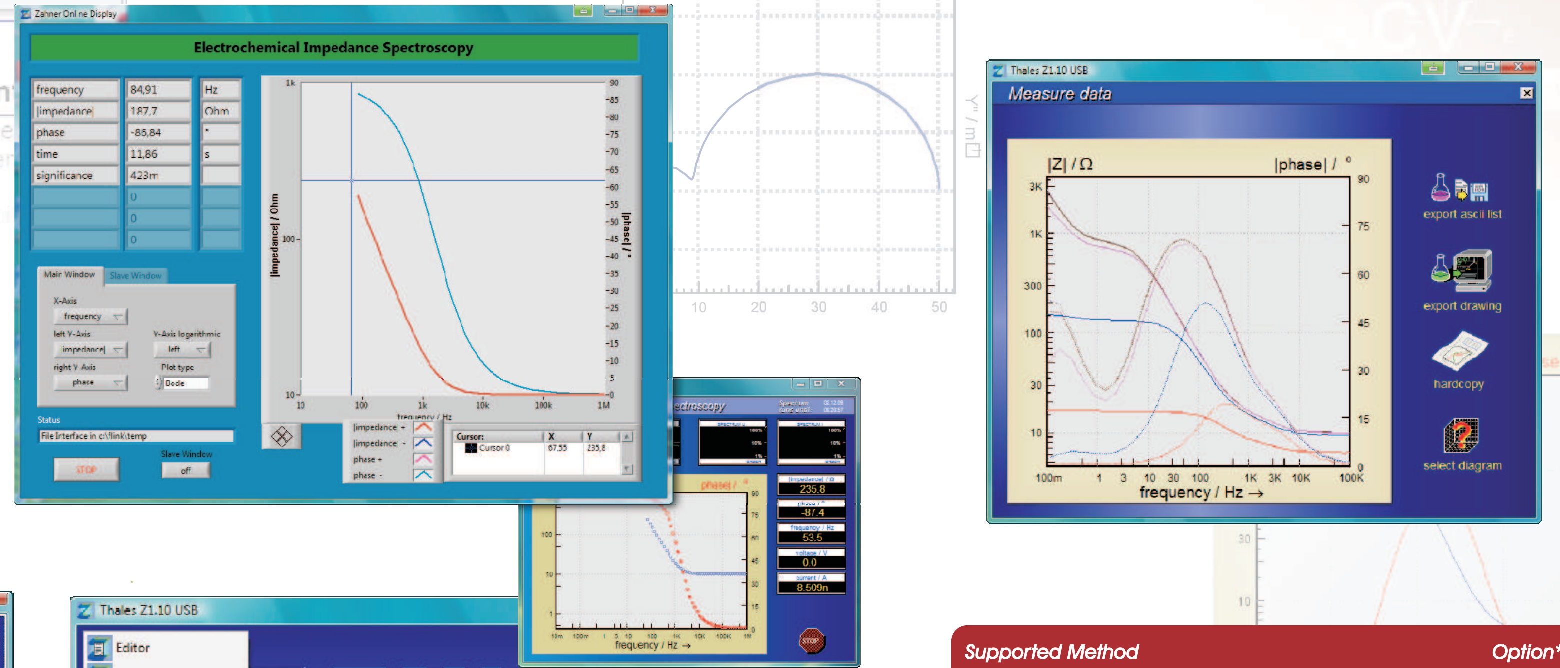
- low impedance applications (fuel cells, batteries, super-caps ...)
- high impedance applications (coatings, laminates, membranes, sensors, corrosion ...)
- photoelectrochemical applications (silicon, dye-sensitized and organic solar cells, organic LED, semiconducting films ...)

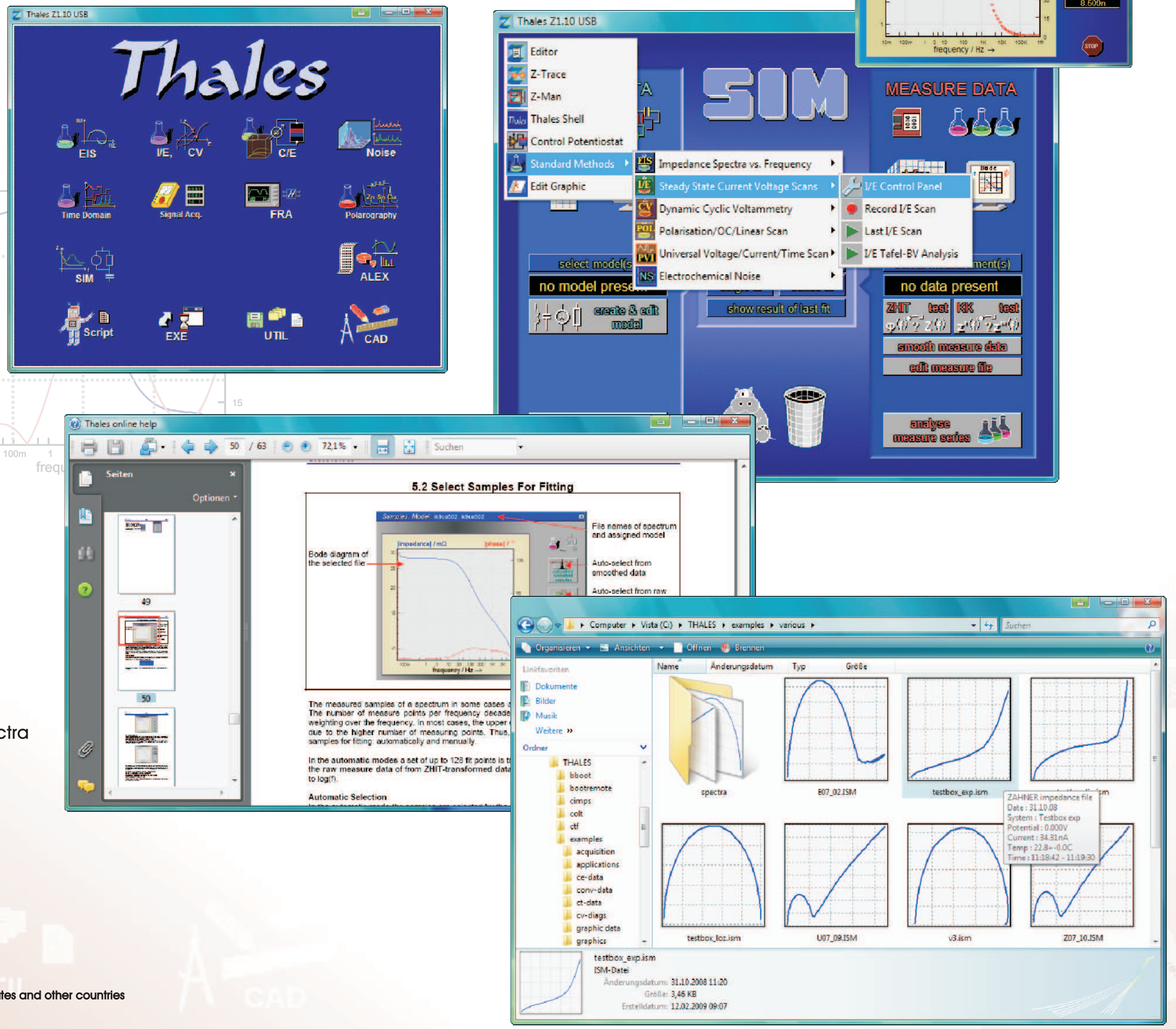
Look & Feel

- electrochemical method guide
- free scaleable application window
- Windows® tooltips
- ThalesViewer (Windows® Explorer extensions)
- fast online help system
- direct access pull down menus
- child windows for configurable online measurement display

Special Functionalities

- fast multiple fitter for impedance and photovoltage/current spectra
- special modeling support for solar cells
- joint multiple transfer function fitting
- SCRIPT procedures for user-defined measurement, analysis- and documentation tasks
- multi-channel measuring data acquisition in parallel to the electrochemical experiments
- remote control via LabVIEW® VI





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ZAHNER ZENNIUM
THALES Z software package

Supported Method	*Option**
Electrochemical Impedance Spectroscopy	-
EIS Series Measurements vs. Parameters	-
Impedance Network Analysis, Simulation & Fitting	-
Impedance/Parameter, Capacity/Voltage Curves	-
AC Voltammetry	-
Cyclic Voltammetry	-
Linear Sweep Voltammetry	-
Triangular Wave Voltammetry	-
Cyclic Triangular Wave Voltammetry	-
Chronoamperometry With Multiple Triangular Potential Sweeps	-
Stationary Electrode Voltammetry	-
Chronoamperometry With Linear Potential Sweep	-
Tafelscan	-
Steady State Current/Voltage Curves	-
Multi-Cell Current/Voltage Curves	XPOT, PP series
Corrosion / Polarisation Measurement	-
Potentiometry	-
Chronopotentiometry	-
Chronoamperometry	-
Pulse Plating	-
Universal Current/Potential/Time Curves	-
Time Domain Controlled Measurements	-
Electrochemical Noise	NProbe
CorrElNoise	NProbe
Tast Polarography	-
Differential Pulse Polarography	-
Differential Pulse Voltammetry	-
Stripping Voltammetry	-
Standard Addition Measurement & Analysis	-
Universal Measurement Data Acquisition & Control	NET*
Universal Frequency Response Analysis	-
AC-DC-AC Tests	COLT
Layer Quality Test / Bi-Layer Test	COLT
Fast Pulse & Transient Recording	TR8M
High Current Interrupt Measurements	HCI
Relaxation Voltammetry	NProbe
Solar Cell Fill-Factor, Efficiency, Maximum Power, OCP, ISC	CIMPS
Controlled Intensity Modulated Photocurrent Spectroscopy	CIMPS
Controlled Intensity Modulated Photovoltage Spectroscopy	CIMPS
Lightemission Voltage/Current Characteristic (OPV)	CIMPS +
Spectral Resolved OPV, Absolute PL Quantum Yield	CIMPS +
Spectral Absorbtion Voltage/Current Characteristic	CIMPS +
Photocurrent Spectroscopy	CIMPS +
Quantum Efficiency, Incident Photon to Charge Carrier Efficiency	CIMPS +
Cross Transfer Function Measurements	-
Membrane Penetration Transfer Function Measurements	-
Programmable Procedures	-

*) Required hardware options