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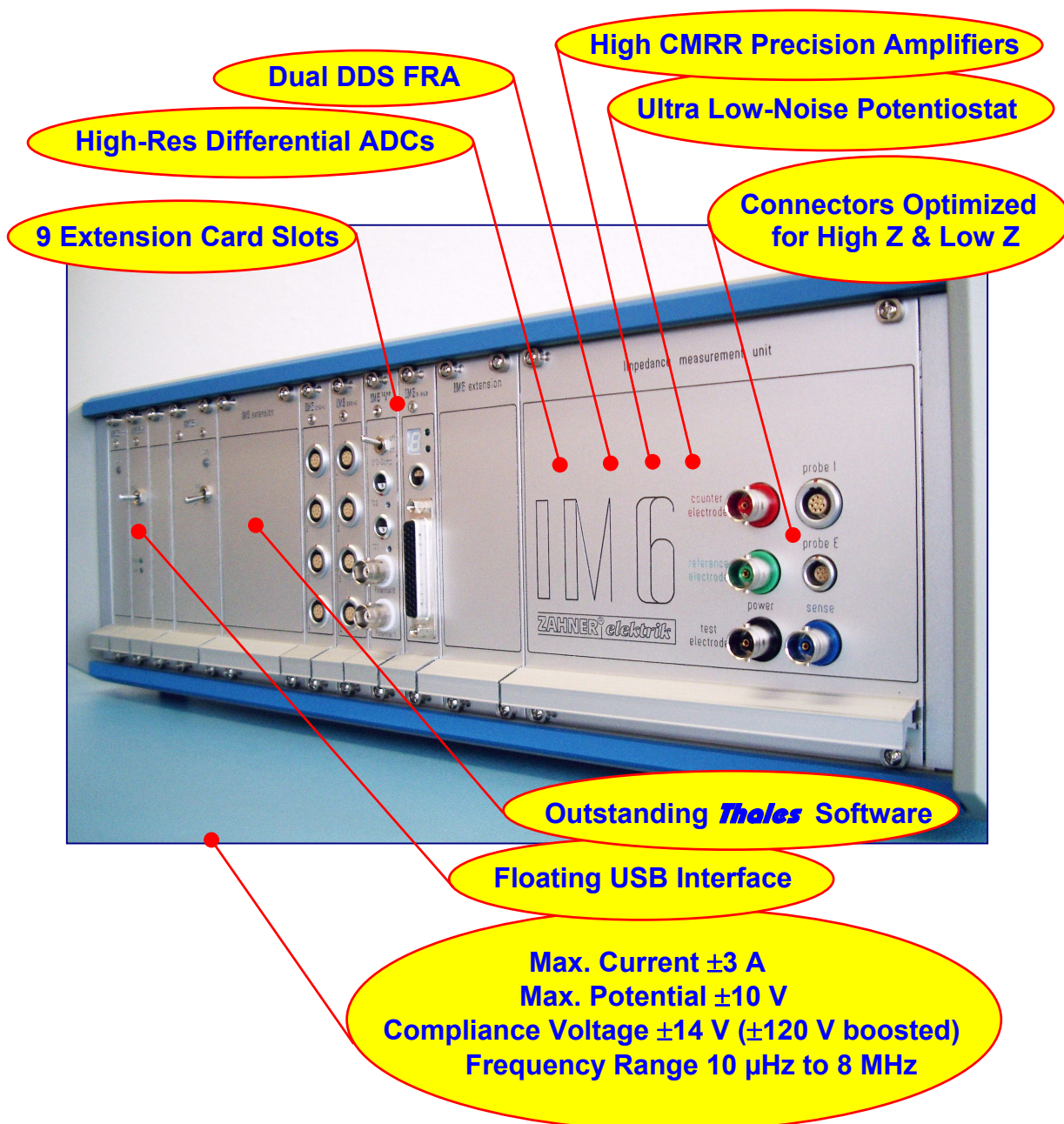
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Electrochemical Workstation

IM6

New Version – New Features – Simply the Best



ZAHNER[®]
M e s s y s t e m e

The Electrochemical Workstation **IM6** is the flagship of the famous **IM** family. It was developed using our 25 years of experience in producing high-precision electrochemical workstations of the high-end class. It provides high-end features such as an 8 MHz frequency range, +-3 A output current, nine extension slots and an USB interface. Special measurement techniques guarantee an ultra high accuracy and a minimal interference with the test object.

The **IM6** comes bundled with the outstanding **Thales** software package which offers all standard methods and more at a mouse click. This is why the **IM6** can easily be adapted to very different measurement requirements. Furthermore, with the manifold options available, the **IM6** is able to grow with its tasks. Thus, it is best suited for investigations on fuel cells and batteries as well as on membranes and sensors or on coatings and laminates – to name only a few.

Last but not least, Zahner is known to provide the most competent service all around the world. Our 25-years experience does not only cover the electronics but also the electrochemical part with its partially complex applications.

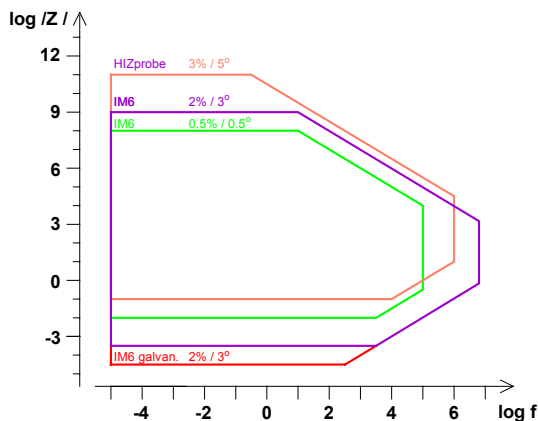
hardware

The high-end hardware of the **IM6** provides

- ultra low-noise potentiostat
- wide frequency range DSS FRA
- high CMRR precision U/I-amplifiers
- high resolution differential ADCs

All these components are designed to work together in a perfect way. This results in a homogeneous and compact instrument with extraordinary technical data.

The accuracy map of the **IM6** clearly shows the high quality of the hardware.



The **IM6** is a highly versatile instrument providing a lot of standard applications. Furthermore, it can be extended with additional hardware and software. This makes it easy to adapt it to a lot of very different applications from the high-impedance end (corrosion, laminates, coatings, etc.) to low-impedance objects (batteries, fuel cells, etc.). If in the course of an investigation it turns out that additional methods are needed, it is no problem to fit the **IM6** to that new situation. For this purpose the **IM6** provides eight slots for plug & play extension cards. Thus, you may e.g. have up to 16 external potentiostats plus additional analog inputs connected to the **IM6**. No matter if you decide to

record additional channels (temperature, pH, etc.) or if you need higher currents or you have to investigate electrochemical noise or ... or ... - simply plug in the appropriate card, connect the test object, and start working. The **Thales** software supports all options automatically and provides the methods needed.

The highest priorities for the development and production of the **IM6** instruments are accuracy and reliability. For that reason we do not waste paper with senseless specifications like a "virtual" resolution calculated from the resolution of the AD converter. The resolution and accuracy we specify are real ones relevant to the use in practice and based on the high-end hardware we use.

The **IM6** is equipped with an **EPC40** card which allows the connection of external potentiostats and comes with a **ThalesBox** for the analysis of measured data on a separate PC.

options

Option	Function	ext	int	EPC40 needed
TEMP/U	2 inputs for thermocouples + 2 voltage inputs		x	
DA4	4 analogue 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		
EPC40	Control module for up to 4 external potentiostats		x	
EPot	External standard potentiostat	x		x
PP series	External power potentiostats	x		x
EL series	External electronic 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-intensity controlled IMPS	x		x
EIChem Cells	KMZ and AMZ type cells for various applications			

methods

Supported Method	Module	Option
Electrochemical Impedance Spectroscopy	EIS	-
EIS Series Measurements vs. Parameters	EIS	-
Impedance Network Analysis, Simulation & Fitting	SIM	-
Impedance/Parameter, Capacity/Voltage Curves	C/E	-
AC Voltammetry	C/E	-
Cyclic Voltammetry	CV	-
Steady State Current/Voltage Curves	I/E	-
Multi-Cell Current/Voltage Curves	M/I/E	EPC40
Corrosion / Polarisation Measurement	POL	-
Chronoamperometry	PVI	-
Linear Sweep Voltammetry	PVI	-
Electrochemical Noise	NOISE	Noise
CorrEINoise	NOISE	Noise
Tast Polarography	PGY	-
Differential Pulse Polarography	PGY	-
Differential Pulse Voltammetry	PGY	-
Stripping Voltammetry	PGY	-
Standard Addition Measurement & Analysis	PGY	-
Universal Measurement Data Acquisition & Control	ACQ	NET*
Universal Frequency Response Analysis	FRA	-
AC-DC-AC Tests	COLT	COLT
Layer Quality Test / Bi-Layer Test	COLT	COLT
Fast Pulse & Transient Recording	TRC	TR8M
High Current Interrupt Measurements	PULSE	TR8M
Relaxation Voltammetry	RV	Noise
Controlled Intensity Modulated Photo-Spectroscopy	CIMPS	CIMPS
Programmable Procedures	SCRIPT	-

software

The *Thales* package supplied with the **IM6** is one of the most sophisticated software packages for electrochemical applications. On the one hand it provides a huge variety of methods, on the other hand it is easy to use even for not trained personnel. Help pages are popping up on a mouse click showing hints for most of the functions.

With **SIM**, the user is able to design equivalent networks on the screen and fit them to the measured data. Especially this part of the *Thales* software is one of the most sophisticated one in the market today. Besides a big library of all electrochemical standard elements you can easily add user-defined elements. More highlights are the automatic finding of starting values for the network elements and the versatile processing of time dependent effects.

SCRIPT allows you to program your individual procedures easily, so that even complex measurement- analysis- and documentation tasks will run automatically. There are some ready-to-use **SCRIPTs** available from Zahner, such as **COLT** or **CIMPS**.

Many electrochemical standard methods are available in the *Thales* package and can be used without additional hardware. Some others are implemented in *Thales* but need additional hardware (see table to the left). External potentiostats are connected to the **IM6** through **EPC40** cards, controlling up to 4 pots each (up to 16 pots in total). The **IM6** comes with one **EPC40** installed.

The **IM6** can be controlled from external software (e.g. **LabView®**). The same way, *Thales* is able to control external instruments through the **NET** software interface (TCP/IP).

General

Overall bandwidth	DC - 8 MHz	PC interface	USB 1.1 / 2.0
ADC/DAC resolution	16 bit	Accessories	EPC40, ThalesBox, U-buffer, USB cable, short & long cell cable set, manual
Extension slots	9	Dimensions	470 x 160 x 376 mm
Shell	ground	Weight	15 kg
Harmonic reject	> 60 dB @ 0.5 full scale	Ambient temperature	+10°C to +30°C without derating
Potentiostat modes	potentiostatic, galvanostatic, pseudo-galvanostatic, pseudo-rest-potential, off	Humidity	< 60% without derating
Cell connections	2-, 3-, 4-terminal Kelvin		

Frequency Generator & Analyzer

Frequency range	10 μ Hz to 8 MHz	AC-amplitude	1 mV to 1 V
Frequency accuracy	< 0.01%	Common mode rejection (differential inputs)	> 80 dB at 10 μ Hz to 100 KHz
Frequency resolution	0.01%	Impedance range pot. /w buffer	> 60 dB at 100 KHz to 8 MHz
	5000 steps / decade	Impedance range galv.	1 m Ω - 1 G Ω / \pm 2%
Input channel phase-tracking accuracy	\pm 0.1 deg at 10 μ Hz to 100 KHz		100 m Ω - 100 G Ω / \pm 3%
	\pm 0.25 deg at 100 KHz to 8 MHz		30 μ Ω - 1 G Ω / \pm 2%

Internal Potentiostat

DC-Characteristics

Counter electrode	compliance voltage	\pm 14 V (up to \pm 120 V boosted)
	output current	\pm 3 A
Continuous power		42 W
Potential ranges		\pm 1 V, \pm 2 V, \pm 4 V, \pm 10 V
Resolution		64.000 steps / range
Input impedance	without buffer	1 T Ω // \pm 5 pF (typical), 50 G Ω // \pm 5 pF (min.)
	with buffer	10 T Ω // \pm 1 pF (typical), 1 T Ω // \pm 1 pF (min.)
Input current	without buffer	10 pA
	with buffer	12 fA
Voltage temp. stability		< 25 μ V/° C

Dynamic data

Small signal rise time	250 ns to 200 μ s in 5 steps, automatic range selection
Slew rate	15 MV/s
Bandwidth (-3 dB)	8 MHz @ 33 Ω load
Phase shift	10 deg at 200 KHz
Offset voltage	< 100 μ V
Offset temp. stability	< 20 μ V/°C
Equiv. effective input noise	20 μ V rms / 2 pA rms @ 1 mHz - 10 Hz

Potentiostatic mode

Potential range	\pm 4 V (standard), \pm 10 V (extended)	
Resolution	125 μ V (standard), 320 μ V (extended)	
Accuracy	\pm 250 μ V (standard), \pm 1 mV (extended)	
Input current ranges	\pm 1 nA to \pm 3 A in 26 steps, automatic range selection	
	minimum resolution	0.1%
	accuracy	\pm 0.05% of range at 2 μ A to 100 mA
		\pm 0.5% of range at <2 μ A or >100 mA
IR Compensation	Method	Auto AC impedance technique
	Positive feedback range	0 to 10 M Ω
	Resolution	0.012% of range

Galvanostatic mode

Current range	\pm 0.1 μ A to \pm 3 A nominal in 24 steps	
	minimum resolution	0.025%
	accuracy	0.1% of range at >2 μ A to 100 mA
		1% of range at <2 μ A or >100 mA

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