ZAHNER

PRECISION IN ELECTROCHEMISTRY

ZENNIUM X - Made in Germany

ZENNIUM X

THE ULTIMATE HIGH PERFORMANCE

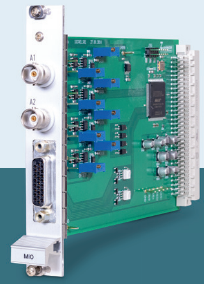
Application Fields

Zahner potentiostats are designed as a modular concept, giving users the **freedom to customize** their potentiostat according to their needs.

- High Power Applications
- Photoelectrochemistry / Photovoltaics
- Electrochemistry

Addon Cards

Plug-and-play cards introduce additional input/control signals to the **ZENNIUM potentiostat.**

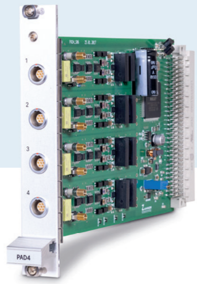


MIO

→ Additional analog & digital input/output channels for the ZENNIUM potentiostat

→ Allows process automatization via Thales scripting or remote integration

→ Analog channels provide 16-bit resolution at a range of ±10 V

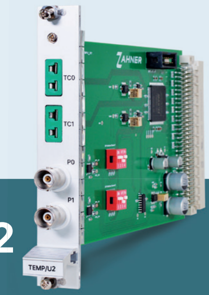


PAD4

→ For detailed stack characterization

→ Enable parallel measurement of each cell in a stacked system (batteries, fuel & electrolyzer cell stacks)

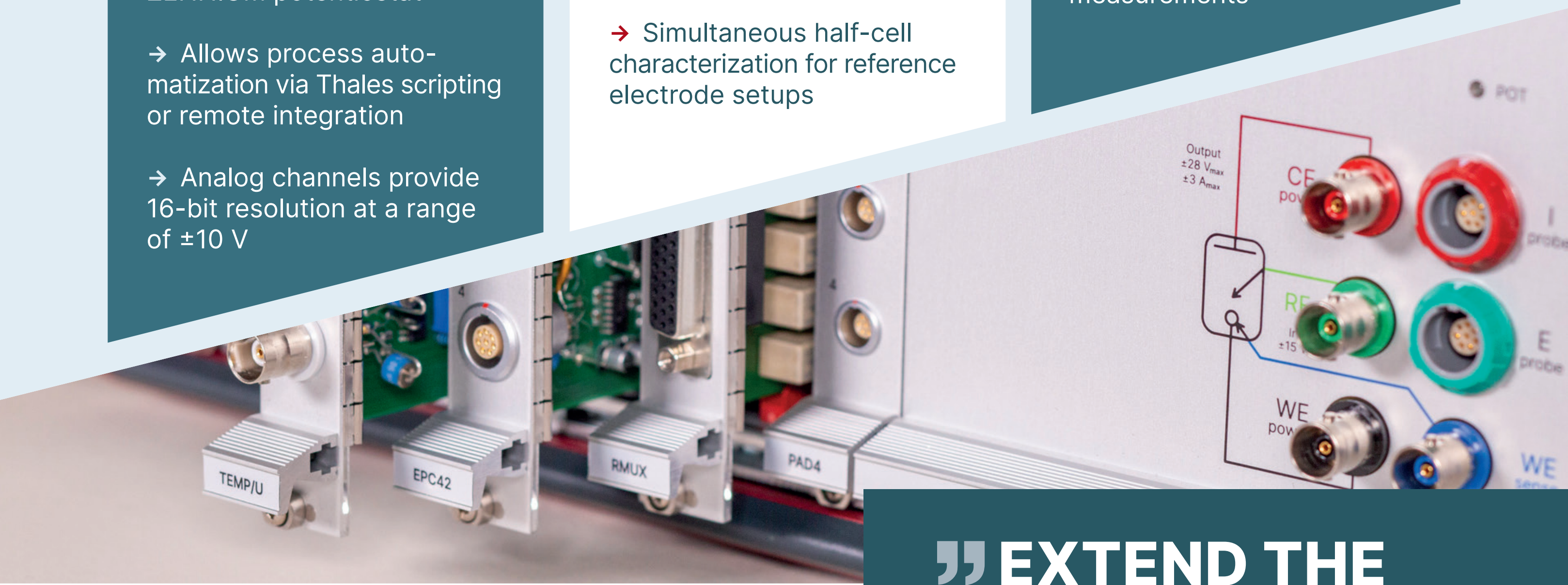
→ Simultaneous half-cell characterization for reference electrode setups



TEMP-U2

→ Two temperature recording channels

→ Two configurable input-voltage channels for recording data from external devices like a pH meter, pressure chamber, etc., during electrochemical measurements



EXTEND THE FUNCTIONALITY OF YOUR POTENTIOSTAT

Extensions For Power Applications

Extend your **ZENNIUM potentiostat** for high quality impedance at high currents.

Extension For Medium Power Applications

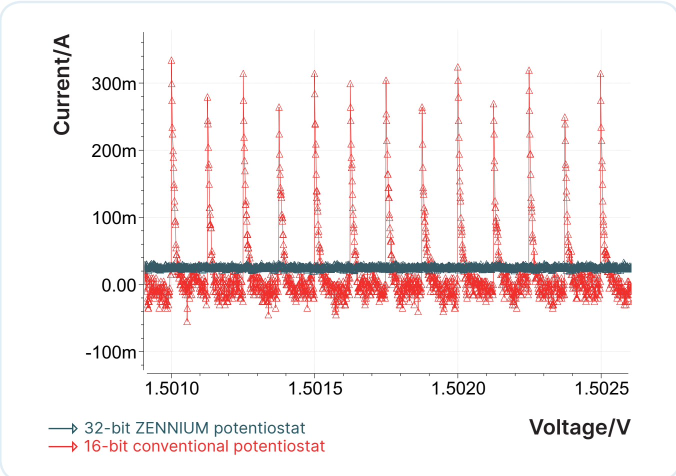
→ Power potentiostats (PP) with power up to 200 W
→ Current up to ±40 A, voltage up to ±20 V
→ Remote integration possible via Python and C++

Extension For High Power Applications

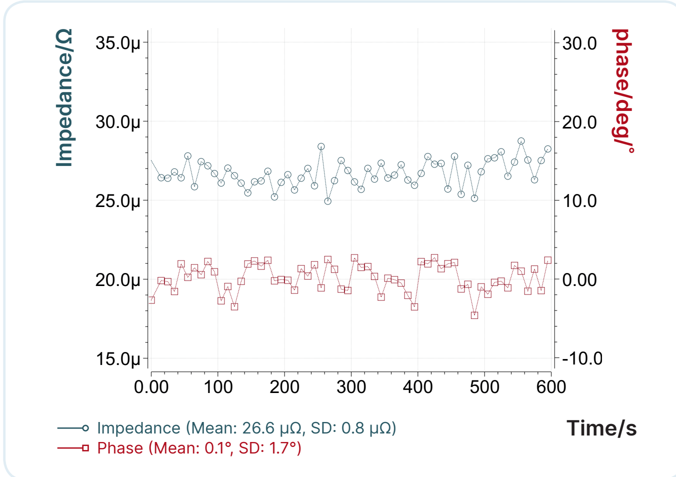
→ Electronic load (EL) system with power up to 68 kW
→ Current up to ±680 A, voltage up to ±100 V
→ Remote integration possible via Python and C++

Main Specifications

- → EIS frequency range 10 µHz – 12 MHz
- → 32-bit DC and 24-bit AC resolution
- → ±5 V / ±15 V voltage range
- → ±4 A over 12 current ranges
- → Online data processing for outstanding EIS



Slow CV scans with a scan rate of 10 µV/s on a highly capacitive system with the ZENNIUM potentiostat (32-bit DAC resolution) and a conventional potentiostat (16-bit DAC resolution).

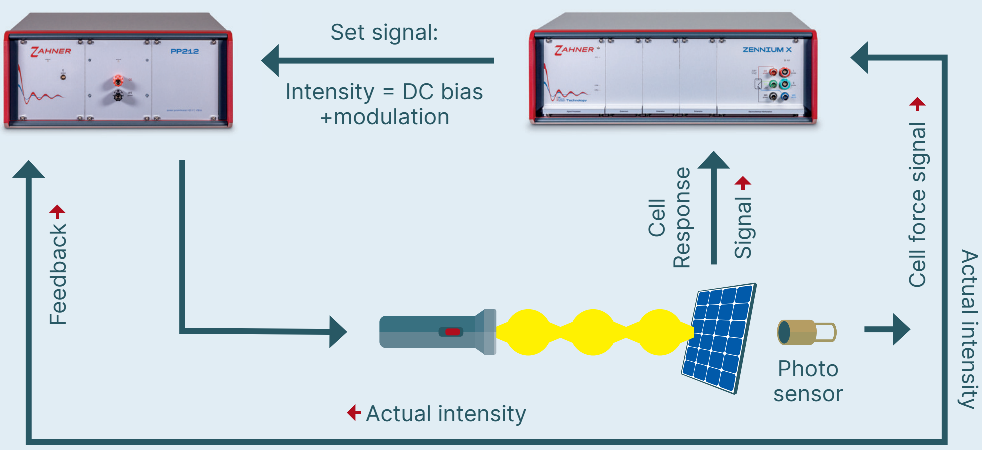


Single frequency (1 Hz), single period impedance measurements on a 25 µΩ resistor vs. time. The measurement is carried out with 1 A amplitude.

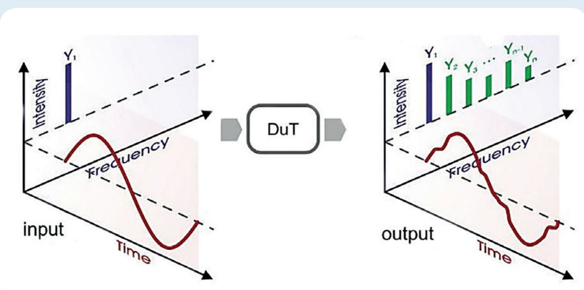
"THE HIGH-END POTENTIOSTAT"

Our Strengths

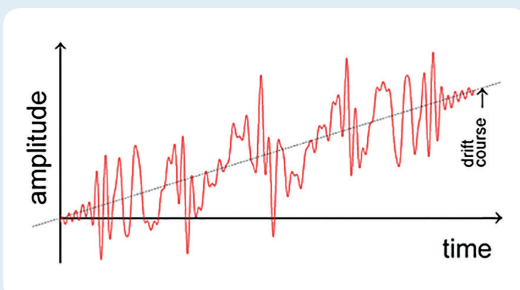
We offer diverse extension possibilities for various electro-chemical, photo-electrochemical/photovoltaic applications.



CIMPS: Extend the potentiostat for use in the field of photoelectrochemistry/photovoltaics. The CIMPS system with its extensions support IMPS/IMVS, IPCE, spectroelectrochemistry measurements and many more.



NFRA: ZENNIUM potentiostats can measure harmonics during the impedance measurement, making it capable to carry out non-linear frequency response analysis.

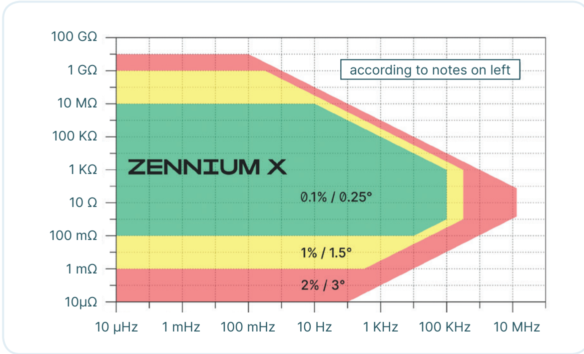


IM-Sine: ZENNIUM potentiostats can carry out intelligent multi-sine EIS measurements, significantly decreasing the total measurement time.

For more information:

Accuracy Contour Plot

- Z > 0.1 Ω: potentiostatic mode, amplitude 10 mV
- Z > 1 MΩ: potentiostatic mode, amplitude 50 mV, shielded
- Z < 0.1 Ω: galvanostatic mode, amplitude 100 mA
- Z < 0.01 Ω: galvanostatic mode, amplitude 1 A
- Without DC bias voltage/current
- Specified at the BNC terminals



Specifications

Potentiostatic modes	potentiostatic, galvanostatic, pseudo-galvanostatic, rest potential, ZRA, off
ADC resolution	32 bit
Function generator	digital and analog (ADF - for scan rates up to 10 kV/s)
Harmonic reject	> 60 dB @ ½ full scale
Cell connection	2-, 3-, 4-terminal kelvin
Ground reference	grounded, floating

Frequency generator & analyzer	Low range	High range
EIS frequency range	10 µHz to 12 MHz	
AC amplitude	0 to 2 V, 24 bit resolution	0 to 6 V, 24 bit resolution
Accuracy	< 0.0025%	
Resolution	0.0025%, 10,000 steps/decade	

Output potentiostatic	Low range	High range
Controlled voltage	±5 V	±15 V
Resolution	2.5 nV	7.5 nV
Accuracy	±50 µV ± 5 ppm of reading	±200 µV ± 5 ppm of reading
Integral nonlinearity	typ. 1 ppm, max. 2 ppm	typ. 3 ppm, max. 8 ppm
Compliance voltage	±16 V	±32 V
Bandwidth	DC to 15 MHz @ 33 Ω load	
IR compensation	auto AC impedance technique, range 0 to 10 MΩ, resolution 0.012%	
Small signal rise time	150 ns to 200 µs in 5 steps, automatic selection	
Slew rate	15 MV/s	
Phase shift	10° @ 500 kHz	

Output galvanostatic	
Controlled current	±4 A
Current range	±1.9 nA to ±4 A in 12 current ranges
Resolution	32 bit ± 0.2 ppb of FS
Accuracy	±0.025% of reading ± 0.01% of FS, ≥1 µA to 100 mA ±0.1% of reading ± 0.05% of FS, < 1 µA or > 100 mA

Input	Low range	High range
Max. input voltage	±5.5 V	±16 V
Voltage resolution	2.5 nV	7.5 nV
Voltage accuracy	±20 µV ± 2 ppm of reading	±50 µV ± 5 ppm of reading
DC current resolution	2 aA (32 bit)	
DC current accuracy	±0.05% of reading ± 0.01% of FS @ 1 µA ... 100 mA ±0.5% of reading ± 0.1% of FS @ 100 mA ... 4 A ±0.5% of reading ± 0.1% of FS @ 10 nA ... 1 µA ±0.5% of reading ± 125 fA @ < |1 nA| (HiZ-Probe)	
Input impedance	> 10 TΩ || ±5 pF typ. (Main) / > 1000 TΩ || ±1 pF typ. (HiZ-Probe)	
Input leakage current	< ±200 fA typ., < ±2 pA max., / < ±10 fA typ. (HiZ-Probe)	
Impedance range	1 mΩ to 10 GΩ / 1% (Main) 100 mΩ to 10 MΩ / 0.1% 100 mΩ to 100 GΩ / 2% (HiZ-Probe) 10 µΩ to 1 GΩ / 2% (Gal) 1 mΩ to 10 MΩ / 0.2%	
Common mode rejection	> 86 dB @ 10 µHz to 100 kHz > 66 dB @ 100 kHz to 12 MHz	
Input channel phase-tracking acc.	±0.05° @ 10 µHz to 100 kHz ±0.125° @ 100 kHz to 12 MHz	
Equivalent effective input noise	1 µV rms / 100 fA rms @ 1 mHz to 10 Hz	

General	
PC interface	USB 2.0
Dimensions / Weight	160 × 470 × 376 mm³ / 13.2 kg
Power supply	100/115/230 VAC, 50/60 Hz
Ambient temperature / humidity	+10 °C to +30 °C / < 60% without derating

Zahner Analysis

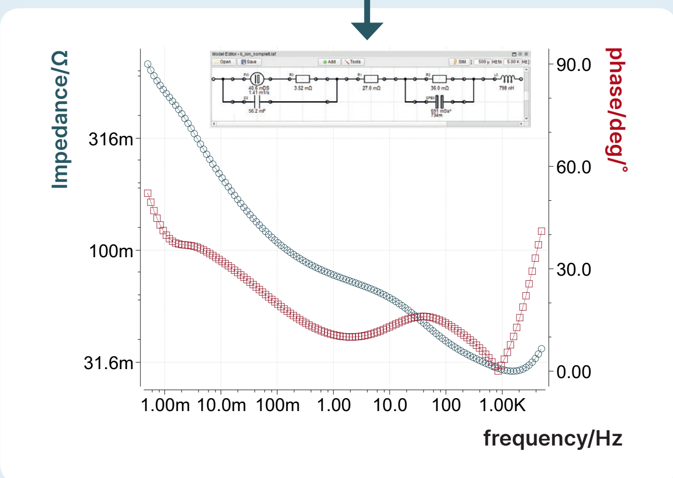
EIS fitting

- Create equivalent electrical circuits
- Fit impedance spectra
  - Single fit
  - Series fit
- ZHIT tool
- Significance plot
- Fitting accessible via API

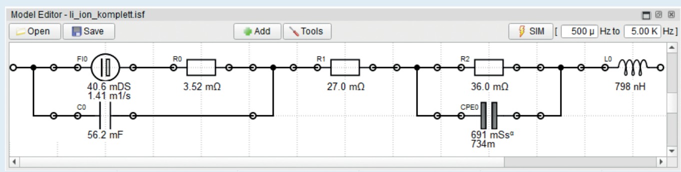
Other techniques

- Cyclic voltammetry
  - Peak determination
  - Charge integration
- Tafel slope measurements
- Butler-Volmer measurements
- Analysis of photoelectrochemical measurements

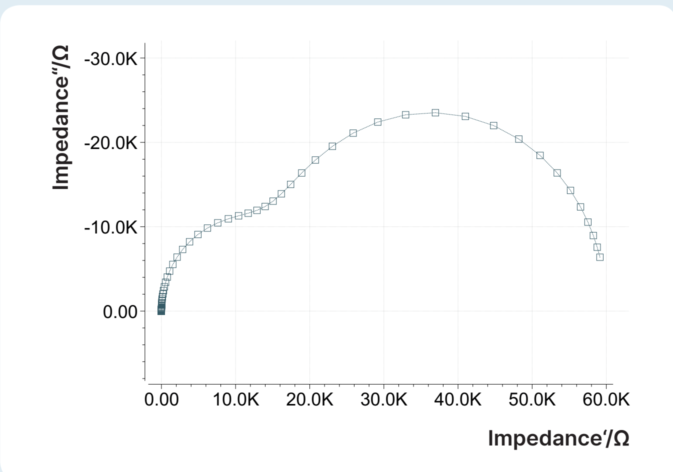
Check out Zahner Analysis videos:



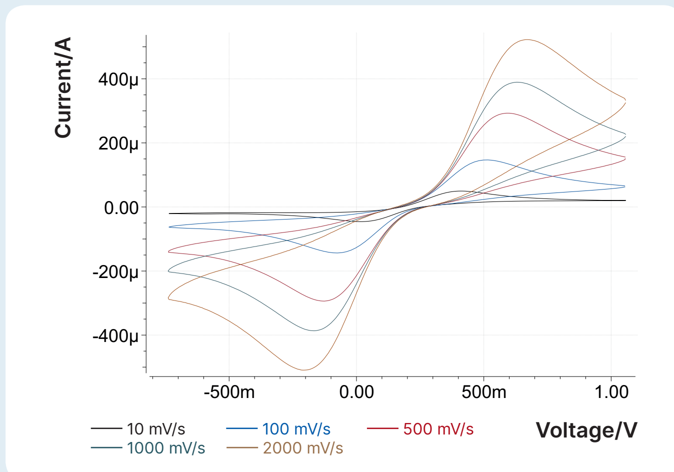
Impedance spectrum (Bode plot) of a battery with the equivalent electrical circuit



Create your own equivalent electric circuit for EIS fitting



Impedance spectrum (Nyquist plot) with two time constants



CV scans measured at different scan speeds

ZHIT

The Zahner Analysis software features the unique **ZHIT** tool, which helps identifying artifacts in impedance spectra and allows reconstruction of artifact-free impedance spectra for fitting.

Significance Plot

Zahner Analysis software features an exclusive tool called the **significance plot**, which evaluates the frequency-dependent significance of equivalent circuit elements in the fitting.

Remote Integration Possible With:

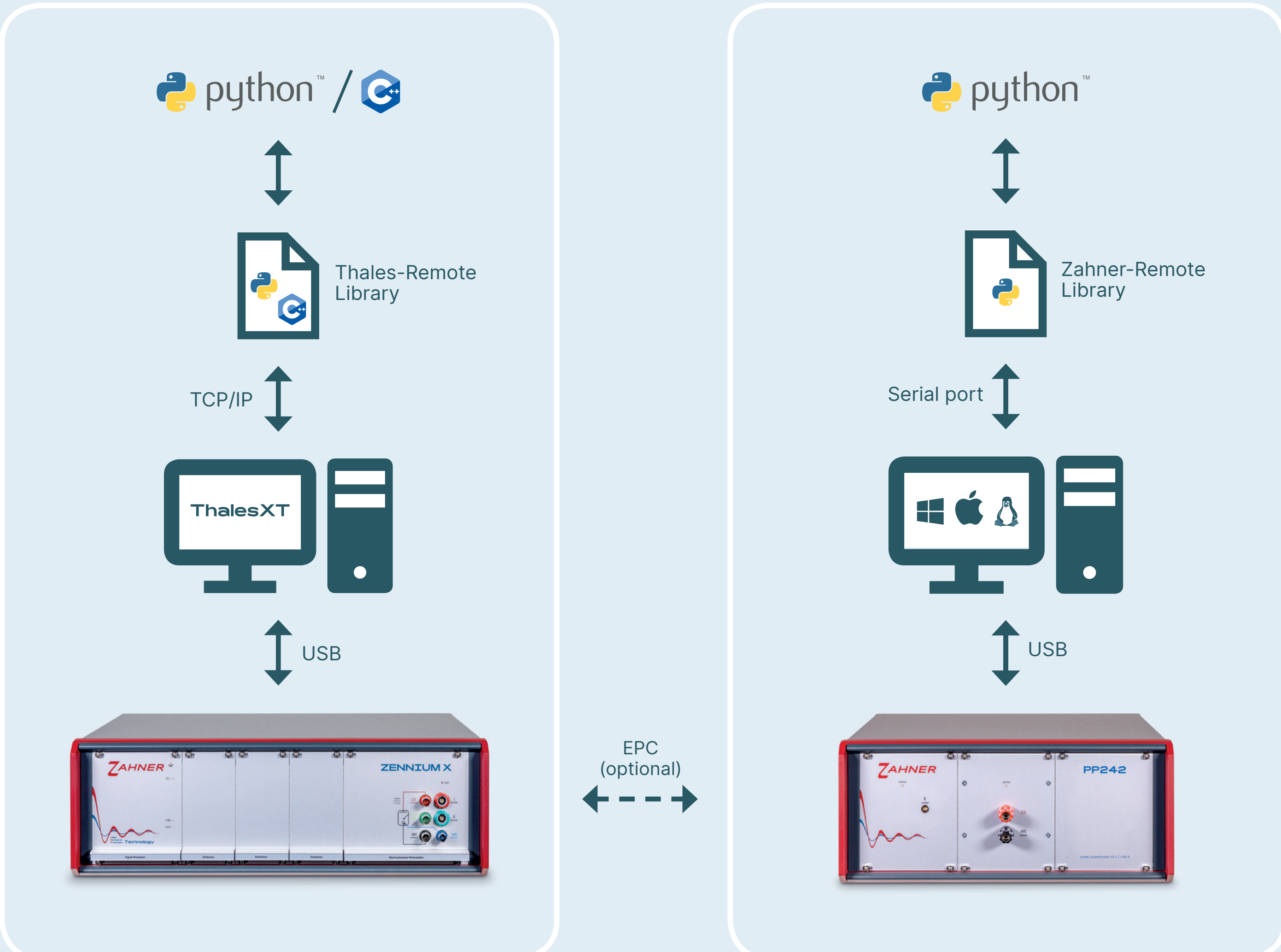
- Python
- C++
- TCP/IP

"FROM REMOTE MEASUREMENT TO REMOTE DATA ANALYSIS"

Automate Your Electrochemistry

Integrate our potentiostats into your test bench for seamless operation. Zahner offers flexible remote control of the devices with ease. By integrating multiple potentiostats into a test bench, the user can create a high-quality multichannel system. Remote integration is possible via Python and C++.

Check different connection schemes:



Check out the QR code for useful examples and complete API documentation.

Zahner-Elektrik GmbH & Co. KG
contact@zahner.de
www.zahner.de

Per l'Italia:
Quantum Design s.r.l.
Dario D'Ubaldo
dubaldo@qd-europe.com
www.qd-europe.com