For over 45 years HEKA has designed and manufactured sophisticated instrumentation and software for biomedical and industrial research applications. Through the years, HEKA has achieved an unparalleled reputation for precision and quality. Medical, pharmaceutical and industrial research facilities world-wide rely on HEKA ingenuity for their discoveries.

While there have been many changes in research, instrumentation, and software, our commitment to bring innovative technology to our customers remains constant. HEKA is a select group of engineers, biomedical researchers, and computer scientists who pride themselves on the quality of HEKA products. HEKA offers complete pre- and post-sales technical support, and takes care of each customer personally. In every way, HEKA provides solutions.

HEKA Elektronik GmbH is proud to be part of the new Smart Ephys umbrella. Together with our other Harvard Bioscience, Inc. brands Multi Channel Systems GmbH, Triangle BioSystems International and Warner Instruments we now offer complete solutions for both electrophysiology and electrochemistry with unprecedented synergy.

You will still find the high-quality products and service that you know and trust from each of the individual companies, but you can now get information on all products, complete set-ups (e.g. patch clamp rigs), and product consultation from one source.

Please check out the new Smart Ephys website and contact your local sales representative with any questions.
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>4</td>
</tr>
<tr>
<td>SECM Techniques</td>
<td>5</td>
</tr>
<tr>
<td>Micro- and Nanopipette Techniques</td>
<td>6</td>
</tr>
<tr>
<td>Shear Force Sensing</td>
<td>7</td>
</tr>
<tr>
<td>Techniques for Corrosion Science</td>
<td>8</td>
</tr>
<tr>
<td>ElProScan Components and Features</td>
<td>9</td>
</tr>
<tr>
<td>Integrated Microscope Optics</td>
<td>10</td>
</tr>
<tr>
<td>Fluorescence and Ratiometric Imaging</td>
<td>11</td>
</tr>
<tr>
<td>Single Cell Imaging</td>
<td>12</td>
</tr>
<tr>
<td>Study of Photoelectrochemical Reactions</td>
<td>13</td>
</tr>
<tr>
<td>Optical Microscopy and Micro-Spectroscopy</td>
<td>14</td>
</tr>
<tr>
<td>Software</td>
<td>15</td>
</tr>
<tr>
<td>System Components and Specifications</td>
<td>16</td>
</tr>
<tr>
<td>Popular Accessories for ElProScan System</td>
<td>19</td>
</tr>
</tbody>
</table>

Further Reading

Additional information such as manuals, technical specifications and PDF brochures for most HEKA products listed in this catalog can be downloaded directly from our web site at [www.heka.com](http://www.heka.com).
Introduction

The HEKA ElProScan is a unique electrochemical scanning probe microscope (e-SPM) system, which employs an ultramicroelectrode and/or nano-/micropipette as a scanning probe to perform in situ high-resolution microscopic imaging of local reactivity and topography of various types of samples and materials. ElProScans are offered in different models and various configurations to tackle a wide range of cutting edge and engineering applications.

• Metals, alloys & cermet
• Active catalysts & carbon substrate
• Semiconductors
• Conductive polymers
• Hybrid nanostructures
• Biological cells & membranes
• Aqueous electrolyte & ionic liquid

Multifunctional Research Tool for Various Materials:

- Environmental Processes
- Nano-Electrochemistry
- Micro-patterning & Micro-fabrication
- Energy Conversion & Storage
- Micro-Sensors
- Electrophysiology & Single-Cell Imaging
- Neurochemical Imaging
- Photoelectrochemical Processes
- Corrosion Processes & Protective Coatings
- Micro-Sensors
- Environmental Processes
- Nano-Electrochemistry
- Micro-patterning & Micro-fabrication
- Energy Conversion & Storage
- Micro-Sensors
- Electrophysiology & Single-Cell Imaging
- Neurochemical Imaging
- Photoelectrochemical Processes
- Corrosion Processes & Protective Coatings
- Micro-Sensors
- Environmental Processes
- Nano-Electrochemistry
- Micro-patterning & Micro-fabrication
- Energy Conversion & Storage
- Micro-Sensors
- Electrophysiology & Single-Cell Imaging
- Neurochemical Imaging
- Photoelectrochemical Processes
- Corrosion Processes & Protective Coatings

ElProScan Supports State-of-the-Art e-SPM Techniques:

- Scanning Electrochemical Microscopy (SECM)
- Scanning Ion Conductance Microscopy (SICM)
- Scanning Electrochemical Cell Microscopy (SECCM)
- Scanning Microcapillary Contact Method (SMCM)
- Scanning Kelvin Probe (SKP) with µ-EIS
- Simultaneous Surface Topography Mapping
- Shear Force regulated Surface Tracking
- Synchronized Fluorescence Imaging
- Scanning Photoelectrochemical Microscopy (SPECM)
- Spatially-resolved Micro-spectroscopy (ECL/DFSS/SERS)

For more information about our different ELP models, consult our product experts at sales@heka.com.
Scanning Electrochemical Microscopy (SECM), with decades of development and evolution, delivers a classical group of electroanalytical scanning probe techniques, capable of imaging and studying substrate topography and local reactivity with high spatial and electrochemical resolutions via the non-contact working electrode, an ultramicroelectrode with diameter ranging from approximately 20 nm to 25 µm. The ElProScan system has been considered by our worldwide users the best-in-class SECM, covering not only the classical working modes, but also many unique advanced scanning modes and combined techniques.

**Classical SECM applications working with a microelectrode and diffusion-limited currents**

- Electrochemical bio-sensors
- Imaging of live cells
- Molecular transport at porous membranes
- Electrocatalysis & photocatalysis
- Ion-selective potentiometric sensors
- Liquid/liquid charge transfer
- Micro-fabrication & patterning of surface
- Corrosion mechanisms

Please contact support@heka.com to obtain Application Notes and Tutorials.
Micro- and Nanopipette Techniques

In addition to SECM with a scanning microelectrode as probe, a unique group of e-SPM techniques employ micro-/nanopipettes as a scanning probe, which is regulated via detecting its ionic current at the tip end for distance-control between the probe and substrate to achieve nanoscale topographical mapping of soft and delicate surfaces. Such a micro-/nanopipette probe can also be modified and used as a bi-functional probe to detect faradaic current (i.e. surface reactivity) from the tip end, which is either submerged in bifunctional electrolyte or operated in a controlled gas environment.

**SICM/SECCM applications working with a micro-/nanopipette and ionic currents**

- **Probe scanned within bulk electrolyte**
  - Non-destructive high-resolution topography imaging
  - Combined SICM – Fluorescence Microscopy
  - Targeted SICM – Patch Clamping
  - Combined SICM-SECM for simultaneous imaging of surface topography and reactivity

- **Probe with a micro-/nanodroplet cell under controlled gas environment**
  - Spatially resolved local electrochemical mapping:
    - Micro-CV & micro-fabrication for conductive samples
    - Combined imaging of electrocatalysis activities and nanoscale topography for nanomaterials

**Investigation of Li-ion batteries inside the glove box**

Working electrode containing lithium scanned by ElProScan SECCM integrated in a glove box.

Similar experiments can be found in Snowden et al. Journal of Power Sources, 325 (2016) 682-689
To overcome the drawbacks in traditional constant-height mode of SECM, Shear Force based height regulation has been proven to be the most effective and reliable mechanism for the advanced constant-distance scan mode, in which the probe scans along the sample’s contour keeping a constant tip-to-substrate distance and the tip current signals are thus decoupled from the substrate’s topographical complications.

The HEKA Shear Force Extension allows simultaneous recording of topography and current signals in constant-distance regulation of SECM and SICM/SECM.

**Constant-distance scan in GC mode with simultaneous topography imaging**

Scheme of constant-distance 2D Scan

*In situ* topography (left) and electrochemical activity (right) maps of conductive polymer (PEDOT film)

**Nanoscale height-tracking for conducting polymer membrane**

Measuring volumetric strains in conducting polymers between oxidized and reduced states


**Topography-correlated transmembrane currents via surface-tracked ion conductance microscopy**

Simultaneously acquired substrate topography and transmembrane currents measured across porous polycarbonate track-etch membranes at different transmembrane potentials

Techniques for Corrosion Science

In material sciences, the study of degradation and corrosion processes is of interest. SECM as well as micropipette techniques have been applied to investigate corrosion kinetics (generation-collection mode of SECM), local corrosion potentials (SECCM) and localized impedance measurements (SMCM). The combination with Shear Force sensing allows constant-distance scans.

**Studying localized corrosion processes at alloys by SECM**

The addition of Ti to ferritic stainless steel inhibits intergranular corrosion but takes part in the initiation of other localized corrosion processes. Spots of high reactivity in SECM images were attributed to Ti-rich inclusions. The localization of alloy elements will help understand localized corrosion resistance.


**Mapping in situ corrosion potentials and surface profile by SECCM**

Corroded Mg alloys were investigated for topography variations and local corrosion rate.

Dauphin-Ducharme et al. Faraday Discussion 2015, 180, 331-345 – Reproduced by permission of The Royal Society of Chemistry

**Simultaneous spatially-resolved imaging of micro-impedance (μ-EIS) and surface topography via Shear Force sensing mode**

Map of μ-EIS (5 kHz)

Map of topography

**Scanning Kelvin Probe (SKP)**

- A material’s work function is an extremely sensitive indicator of surface conditions and is affected by adsorbed or evaporated films or species, surface reconstruction, surface charging, oxide layer imperfections, local and/or bulk corrosion processes.
- HEKA’s SKP scans a vibrating capacitor probe to image work function at true micron scale.
ElProScan Components and Features

The ElProScan system consists of three main modules: the mechanical positioning stage, the dual-channel electrochemical workstation, and a real-time controller. Each of these functional modules is designed to be easily customized to meet your particular application requirements. Model-specific modules include a synchronized optical imaging system and the Shear Force extension.

High-Precision Positioning System

- The ElProScan 3 platform utilizes the highest quality closed-loop controlled multi-axis motorized positioning system. A linear encoder (2.5 nm resolution) at each axis allows a real-time position control with closed loop regulation to eliminate backlashes.
- The XY-motor stage manipulates samples in the XY-direction, and the probe (either an ultramicroelectrode or a nano-/micro-capillary probe) is scanned vertically by a Z-piezo/motor assembly (with 1.5 nm resolution in height measurement).

The New Generation of ElProScan Controller (ESC 5)

- The new ESC 5 Controller may be equipped with hardware lock-in electronics to empower the latest HEKA Shear Force Extension (SFU 3).
- Controller employs on-board computer system to process and integrate real-time positioning data with electrochemical signals online.
- The design allows the ESC 5 Controller to interface with and gain control of a wide range of external analog-driven piezoelectric stages, thus offering a cost-effective upgrade solution to users’ existing non-HEKA scan stage.

Cutting-Edge Electrochemical Resolution for Nanoelectrochemistry

- Low noise: 3.5 fA @ 15 Hz and 31 fA @ 1 kHz
- High resolution: 0.15 fA in 5pA range
- High bandwidth and fast sampling rate

For more information about our different ELP models and customization, consult our product experts at sales@heka.com.
HEKA’s ElProScan allows the integration of an inverse microscope into the scanning platform enabling a wide range of extended techniques.

An illustration of ELP 3 system with epi-fluorescence optics

The Unique Modular Microscope Provides an Extendable Platform

- The system’s built-in inverted modular microscope supports bright/dark field imaging, as well as many types of high-end fluorescence light source (synchronized LED/Xeon/Laser).
- The uniquely configured optical train features modular designs to synchronize tip-scanning with various optical microscopy and micro-spectroscopy techniques.
- The inverted optical axis remains in focus with the collective tip/sample-scanning and hence the optical measurements are synchronized with SPM, which ultimately provides multi-dimensional 3D/4D/5D data and microscopy images within one scan experiment.

The Convenient Oblique 45° Imaging System

The high-speed HD camera may record videos and triggered photos of tip and substrate during scanning probe experiments, which facilitates prepositioning and documenting relative positions of tip and sample.
HEKA SmartLUX for Synchronized Imaging Control

- SmartLUX software allows the user to perform optical image acquisition and electrochemical recordings simultaneously. The timing of fluorescence excitation by the light source, the camera exposure and the electrochemical data acquisitions are all precisely synchronized by the software.
- SmartLUX is an ongoing HEKA research & development project. The current product features high temporal resolution and exact correlation among fluorescence data and electrophysiological & electrochemical data.

**Correlation between fluorescence and electrochemical current signal**

Epi-fluorescence illumination of the microelectrode tip with monochromatic light through the objective

A combination of a fluorescence image with transmitted light image of the mitochondria of one transfected T-cell.

Software oscilloscope window simultaneously displays the timing of the optical measurements, image acquisition and the electrochemical (E/I) signals, all of which are synchronized with a temporal resolution on the millisecond scale.

Three Online Analysis plots show the exact correlation of measured fluorescence intensities with electrochemical current signals.

**SmartLUX techniques support ratiometric Fluorescence Imaging**

**Investigation of calcium concentration**

Snapshots (top-left) from a time lapse calcium imaging experiment using the ratiometric calcium indicator Fura-2.

All ratiometric methods have in common that the intensity of emitted light is measured twice and a ratio (R) of these intensities is calculated to represent relative concentrations of the specific ions.

ElProScan may be tailored to offer a special hardware package to tackle the most challenging requirements of ratiometric imaging.
HEKA’s ELP 3 system pioneered in many of the world’s first imaging applications with its unique integration of synchronized optical microscopy imaging and high-resolution low-noise electrochemical imaging techniques. From molecular sensing to cellular imaging technologies, ELP 3 system has become the ultimate workstation platform defining the latest standard for a new generation of single-cell electroanalytical imaging workstations in interdisciplinary biophysical, bioanalytical, electrochemical and neurochemical applications.

**Molecular imaging and sensing**

- **ROS / RNS species** (e.g. $\text{H}_2\text{O}_2$)
- **Neurotransmitters** (with opto- or electro-stimulations)
- **Active marker molecules** (e.g. FcMeOH for cancer cells)

Detection of $\text{H}_2\text{O}_2$ release at human monocytes by SECM. Images with courtesy of P. Knapp.

Similar experiments can be found in M. Bozem et al., Antioxidants and Redox Signaling, DOI: 10.1089/ars.2016.6840

In situ cellular imaging

- **High-resolution cell morphology imaging** (non-contact SICM mode)

Detection of H2O2 release at human monocytes by SECM. Images with courtesy of P. Knapp.

Similar experiments can be found in T. E. Schaffer, Anal. Chem. 2013, 85, 6988−6994.
Study of Photoelectrochemical Reactions

Scanning Photoelectrochemical Microscopy (SPECM)

In 2016, HEKA launched the first commercial SPECM with combined SECM/SICM/SECCM and in situ synchronized photo excitation for microscopic study and imaging of photoelectrochemical processes on the micron and sub-micron scale.

The innovative SPECM works for a wide range of materials and applications:

- Inorganic Semiconductors
- Semiconducting Polymers
- Hybrid Nanostructures
- Organic Photovoltaic Materials
- Solar to Electricity Conversion (solar cells)
- Solar to Chemical Energy Conversion (Water splitting and CO₂ reduction)
- Photosterilisation, Self-Cleaning Surfaces
- Environmental (air and water) Remediation

- **Simultaneous mapping** of microscopic distribution of photocurrent, IPCE/QE, photo-sensitive products or intermediates, and high-resolution surface topography within one scan.
- **Automatic multi-wavelength switching** synchronized with dual-channel current recordings

### SPECM imaging of photocatalysts activity in water-splitting reaction

<table>
<thead>
<tr>
<th>3D Map of Topography by Shear Force Sensing</th>
<th>3D Map of Photocurrents (420 nm light)</th>
<th>Distribution of O₂ (i_OER) from OER</th>
<th>Derived 3D Map of IPCE ratio (λ₁/λ₂)</th>
</tr>
</thead>
</table>

- Innovative SPECM setup supports optical fiber couplings with SECCM microdroplet cell or SICM mode using HEKA’s Opto-Pipette Holder.

Top-illumination via Opto-Pipette in microdroplet cell mode (left) and top camera view of Opto-Micropipette tip (right) and mirror image from a wafer sample

Please refer to the full HEKA SPECM Brochure for more details.
The Innovative ELP 3 for Combined Microscopy and Micro-Spectroscopy

The 2019 ELP 3 in SPECM-FL optical configuration features a seamless integration of epi-fluorescence optics with optical fiber-coupled excitation/detection light paths, targeting a variety of optical microscopy and micro-spectroscopy that can be integrated and synchronized with e-SPM techniques.

Illustrative photo shows ELP 3 inverted dual-light path under the XY-scan stage

The SPECM-FL design facilitates *in situ* microscopic studies of quantum dots or catalysts with synergistic localized energy and electron transfer under two individual wavelengths of light.

Multi-functional platform for Synchronized Micro-Spectroscopy Imaging

The ELP 3 combined platform allows nano-scale imaging and analysis of localized micro-spectroscopy signals from absorption/reflective, surface plasmon resonance (LSPR), DFSS or ECL from individual particles or molecular entities for development of biological nano-sensors.

Please consult with support@heka.com to determine which one of the ELP 3 configurations is the most suited for your research.
HEKA software for ElProScan (POTMASTER and PATCHMASTER) has been developed to provide powerful and flexible data acquisition, data analysis, and plotting functions. Always compatible with all versions of Windows (XP – Win10) and MAC OS, it supports the world’s most comprehensive and up-to-date electrochemical scanning probe techniques, and additionally, the following unique features are available to empower advanced customization and automation of one’s own experiments.

User-defined protocol scripts for automating a complex experiment

1. **Examples of Protocol-Controlled C.D. Matrix Scan for SECCM/SMCM**

   - **Step-1**: Approach tip to substrate (with stop set-point defined by users)
   - **Step-2**: When tip lands on substrate, record topography height
   - **Step-3**: Hold tip position and sequentially execute a list of user-defined techniques (e.g. run CV / LSV; chronoamp charging & discharging; Tafel plot; turn light On/Off; take camera images, etc.)
   - **Step-4**: Tip is raised to a safe height and hops to next scan point to repeat the above steps.

2. **User-directed template scan for surface patterning and microfabrication**

   Along each scan path, drawn by users in the imported template graph, the software applies a list of user-defined protocol scripts, such as user-defined “etching” or “electrodeposition”.

   - Users may draw any scan path/patterns and save as vector graphics, which may be imported in POTMASTER and used as the probe scan template. The spatial size and resolution of the scan pattern are completely user-defined and can be flexibly matched to the probe size.
   - At each of the predefined spatial points, the software can apply any combination of predefined electrochemical experiments and tip-scanning motions (e.g. pulsed etching, electrodeposition, 3D probe movement, etc.).
   - With one mouse click, the template scan fulfils the functions of surface patterning and/or micro fabrication, and even microscopic 3D printing.
# System Components and Specifications

The following specifications are only applicable to a standard ELP-3 SPECM configuration.

<table>
<thead>
<tr>
<th>Components and Items</th>
<th>Technical Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positioning System with Integrated Microscope Optics</strong></td>
<td></td>
</tr>
<tr>
<td>XY/Z/F 4D positioning system</td>
<td>4-Axis DC servo motors with Z-axis piezoelectric system (X/Y-axis carries sample in scanning; Z-axis carries microprobe, and F-axis drives objective lenses for precise focus).</td>
</tr>
<tr>
<td>Resolution of X/Y/Z/Ax</td>
<td>Linear Encoder of each motor axis = 2.5 nm resolution (all closed-loop controlled); 1.5 nm resolution for the Z-axis piezo module; XY-scan resolution = 10 nm with 4 times oversampling algorithm to ensure accuracy</td>
</tr>
<tr>
<td>X/Y/Z/F Axis Travel Range</td>
<td>Automatic motor-scan range: X = 100 mm, Y = 75 mm, Z and F = 50 mm. Z-axis piezo range = 100 µm (closed-loop controlled). A manual translator unit extends XY range to additional 12.5 mm.</td>
</tr>
<tr>
<td>4D External Joystick</td>
<td>For X/Y/Z/F manual control with sub-micron accuracy; may operate in precise-slow motion and coarse-fast motion.</td>
</tr>
<tr>
<td>Integrated Microscope Optics</td>
<td>The inverted optical train contains a motorized focus drive, epi-fluorescence optics in Kohler configuration (with a variable field stop) and special coupling to a liquid light guide, camera port with C-mount, an optional filter cube holder, and slide-in beam splitter and a mirror cube. Additional fixed-spot size illumination path with coupling to a FC/PC fiber may be added. Optional objectives (4x up to 100x) can be mounted in a 6-position turret nose piece. Microscope optics transmits light of wavelength above 330 nm.</td>
</tr>
<tr>
<td>Optional Upgrade</td>
<td>Top 45° camera system may record and view the microprobe and sample surface in prepositioning, greatly facilitating Z/F-axes alignment and pre-scan preparations.</td>
</tr>
<tr>
<td><strong>Bipotentiostat WorkStation</strong></td>
<td></td>
</tr>
<tr>
<td>Voltage Range / Resolution</td>
<td>± 10V (in single amplifier mode) / 610 nV (compliance ±12V)</td>
</tr>
<tr>
<td>Current Ranges</td>
<td>±20 nA to ±100 mA (Amp-1); ±5 pA to ±2 µA (Amp-2; total 18 ranges available)</td>
</tr>
<tr>
<td>Max. Current Resolution</td>
<td>0.15 fA in 5pA range (Amp-2); 0.61 pA in 20nA range (Amp-1)</td>
</tr>
<tr>
<td>Noise in Current</td>
<td>RMS value &lt; 3.5 fA (at 15 Hz bandwidth in 5 pA range of Amp-2)</td>
</tr>
<tr>
<td>DAC Interface</td>
<td>16-bit / 5 µs fastest pulse / 200 kHz sampling rate</td>
</tr>
<tr>
<td>Optional Upgrade</td>
<td>External EIS measurement module (10 µHz – 2 MHz)</td>
</tr>
<tr>
<td><strong>Photo-Excitation System (optional)</strong></td>
<td></td>
</tr>
<tr>
<td>Synchronized Multi-Wavelength Excitation System</td>
<td>Standard package includes: 300W Xenon arc lamp, shuttered 10-position filter wheel, fused silica light guide, 10 bandpass filters with 10nm bandwidth in the range of 350nm to 800nm, 1 neutral density filter).</td>
</tr>
<tr>
<td>Light Guide to Fiber Coupler Kit</td>
<td>Used for connecting a light guide with 5mm OD and 20mm length fitting to a SMA type optical fiber for the fixed spot-size illumination path.</td>
</tr>
<tr>
<td>Opto-Pipette Holder Kit</td>
<td>A special pipette holder with a straight optical port (SMA type) used for coupling a HEKA cannula to an optical fiber for combined top-illumination in SICM/SECCM experiments.</td>
</tr>
<tr>
<td>Optional Upgrade</td>
<td>Special customization is available for adding Synchronized Fluorescence Imaging module. Additionally, LED and Laser light sources are available.</td>
</tr>
</tbody>
</table>

Please contact support@heka.com to obtain Application Notes and Tutorials.
## System Components and Specifications

<table>
<thead>
<tr>
<th>Components and Items</th>
<th>Technical Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shear Force Extension</strong></td>
<td></td>
</tr>
<tr>
<td>Mechanism</td>
<td>AC modulation of piezo stimulation amplitude and phase</td>
</tr>
<tr>
<td>Topographical measurement</td>
<td>Height resolution = 1.5 nm; simultaneously obtained in an independent data trace with tip current recorded in Constant Distance mode.</td>
</tr>
<tr>
<td>Stimulation Amplitude and Frequency</td>
<td>0 V to 1 V (sine wave); selectable frequency = 100 kHz to 1 MHz</td>
</tr>
<tr>
<td>Constant Distance regulation</td>
<td>Maximum 5 μm (with 1.5 nm as smallest calibration step)</td>
</tr>
<tr>
<td><strong>SECM Scan Mode</strong></td>
<td>1. Automatic and manual Probe Approach Curves (1 nm/s up to 50 μm/s on Z-piezo) 2. Constant-Height 2D/3D Scan at constant velocity (10 nm/s slowest, with slope compensation and user-defined scan axes) 3. Constant-Distance 2D/3D Scan (available modes: Shear Force Hopping / Surface-Tracking / DC Hopping / Z-modulated Hopping for SECM/SICM/SECCM/SMCM) 4. Template Scan (user-defined micro-etching / micro-deposition / micro-3D printing; XY scan cycles available in zigzag or alternative directions) 5. 2D/3D Protocol-Controlled Matrix Scan (each scan point allows running any combination of experiment waveforms and sequence).</td>
</tr>
<tr>
<td><strong>POTMASTER Software</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Supported Electrochemical Techniques | • Classical Voltammetry: Open Circuit Potential; Cyclic Voltammetry, FSCV (up to 2 kV/s), Linear Sweep Voltammetry; Staircase (Linear and Cyclic) Voltammetry, Chronoamperometry, Chronocoulometry, Chronopotentiometry, Normal Pulse Voltammetry, Differential Pulse Voltammetry, Square Wave Voltammetry; Multi-Current Steps; Potentiometric Stripping; RDE/RRDE techniques and many others  
• Devices and Materials Characterizations (e.g. batteries, sensors and biochips, etc.): Charge/Discharge (static and cyclic), Constant Power Tests, Multi-Vertex Scan, Noise Power Spectrum, and on-demand Potentiostatic and Galvanostatic controls with Auto-Stop Criteria (i.e. user-configurable threshold limits on potential, current, charge and power capacity in auto-stopping experiments)  
• Corrosion Techniques: Potentiostatic Polarization, Galvanostatic Polarization, Linear Polarization Resistance, Potentiodynamic Polarization, Tafel plot, Electrochemical Impedance Spectroscopy, etc.  
• Spectroelectrochemistry: supported via built-in DA/AD interface with trigger control and software batch-communication for precise synchronization with external instruments |
| DA/AD Signal Acquisitions | Supporting simultaneous multi-channel analog and digital signal-communications with DA or TTL triggers; built-in fast-speed and low-noise DAC; supporting up to 32 user-defined data traces to be recorded and computed. |
### System Components and Specifications

<table>
<thead>
<tr>
<th>Components and Items</th>
<th>Technical Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Other Optional Upgrade</strong></td>
<td>SKP (Scanning Kelvin Probe): HEKA’s SKP scans a vibrating capacitor probe to image work function of a surface at true micron scale.</td>
</tr>
<tr>
<td></td>
<td>Probes: supporting the use of steel, Pt/Ir or W microelectrodes (various dia. available)</td>
</tr>
<tr>
<td></td>
<td>Z-modulation/vibration: supporting 10nm - 10μm (peak-to-peak), with 1.5 nm increments over the Z-piezo travel range of 100 μm</td>
</tr>
<tr>
<td></td>
<td>Backing Potential: 0V to ±10 V (610 nV resolution)</td>
</tr>
<tr>
<td></td>
<td>Available Scan Mode: Constant Height and Constant Distance modes</td>
</tr>
<tr>
<td><strong>Extendable Peripherals</strong></td>
<td>Supporting online synchronization of a wide range of analytical equipment, such as: RDE/RRDE systems, FTIR spectrometers, UV-Vis Light Source and spectrometers, Photomultiplier tube (PMT), Filter Exchangers, temperature controllers, perfusion system, and research grade CMOS/EMCCD super-resolution cameras.</td>
</tr>
</tbody>
</table>
Popular Accessories for ElProScan System

Microelectrodes (Pt / Au / Ag / Carbon)

Microelectrode Polishing Machine

Electrochemical Cell Stage Insert with Gas Purging and Temperature Control (5-65°C)

Various Light Sources & Filters

Holders for Microelectrodes, Micropipettes and SMA-Fibers

Vibration-isolation & Shielding Devices

Please refer to the full HEKA Electrochemistry Product Overview Brochure for more details.
HEKA Elektronik GmbH
Headquarter
Wiesenstrasse 55
D-67466 Lambrecht/Pfalz
Germany

HEKA Elektronik GmbH
Production & Service Center
Aspenhaustrasse 21
72770 Reutlingen
Germany

HEKA Instruments Inc.
84 October Hill Rd
Holliston, MA 01746
USA

Harvard Bioscience Co., Ltd.
Shanghai
Room 8C, Zhongxi Tower
121 Jiangsu Road
Changning District
Shanghai China 200050

<table>
<thead>
<tr>
<th>Phone</th>
<th>+49-6325-9553-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fax</td>
<td>+49-6325-9553-50</td>
</tr>
<tr>
<td>Web Site</td>
<td><a href="http://www.heka.com">www.heka.com</a></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.elproscan.com">www.elproscan.com</a></td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:sales@heka.com">sales@heka.com</a></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:support@heka.com">support@heka.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phone</th>
<th>+49-7121-909-25-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fax</td>
<td>+49-7121-909-25-11</td>
</tr>
<tr>
<td>Web Site</td>
<td><a href="http://www.heka.com">www.heka.com</a></td>
</tr>
<tr>
<td></td>
<td><a href="http://www.elproscan.com">www.elproscan.com</a></td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:sales@heka.com">sales@heka.com</a></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:support@heka.com">support@heka.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Toll free</th>
<th>+1-800-272-2775</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone</td>
<td>+1-508-893-8999</td>
</tr>
<tr>
<td>Fax</td>
<td>+1-508-429-5732</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:us-sales@smart-ephys.com">us-sales@smart-ephys.com</a></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:support@heka.com">support@heka.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phone/Fax</th>
<th>+86-21-6226-0239</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Site</td>
<td><a href="http://www.harvardbioscience.com.cn">www.harvardbioscience.com.cn</a></td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:apac-sales@smart-ephys.com">apac-sales@smart-ephys.com</a></td>
</tr>
</tbody>
</table>

**General notice:**
Product names used herein are for identification purposes only and may be trademarks of their respective owners. HEKA disclaims any and all rights in those marks.

We reserve the right to effect technical changes as development progresses. Special versions are available on request. Further technical data are available on request.