

# Dekati<sup>®</sup> High Resolution ELPI<sup>®</sup>+

- ▶ Real-time particle size distribution
- ▶ Wide particle size range with one measurement method
- ▶ High size resolution

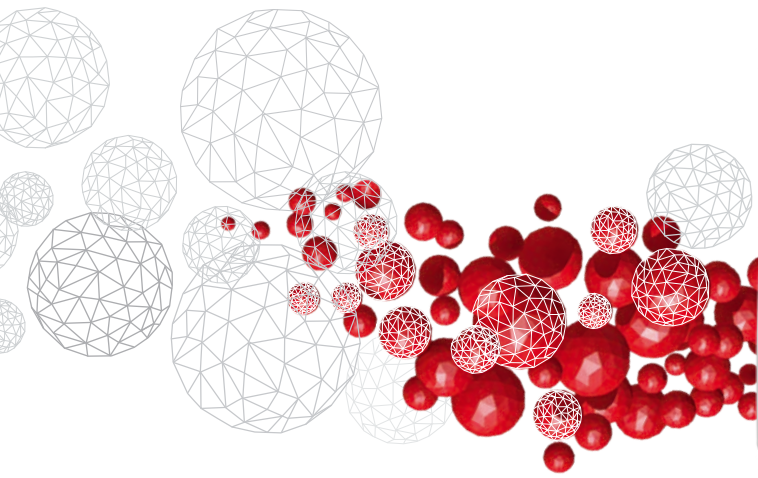


Now with  
particle number,  
LDSA and mass  
concentration



Excellence in Particle Measurements

# Dekati® High Resolution ELPI®+



## Description

The Dekati® High Resolution ELPI®+ (Electrical Low Pressure Impactor, HR-ELPI®+) is an improved version of the widely used ELPI®+ instrument. The High Resolution ELPI®+ combines features of the ELPI®+ with a data inversion algorithm that gives real-time particle size distribution in up to 500 size classes 6 nm – 10 µm. Other High Resolution ELPI®+ features include wide particle sample concentration range, robust structure and possibility to characterize chemical composition of size classified particles after the real-time measurement. The latest addition to the HR-ELPI®+ features is a new Data Analysis Tool software that makes data analysis and visualization fast and easy for the instrument operator. This new tool comes with particle number, LDSA and mass concentration calculations for the HR-ELPI®+.

## Operating principle\*

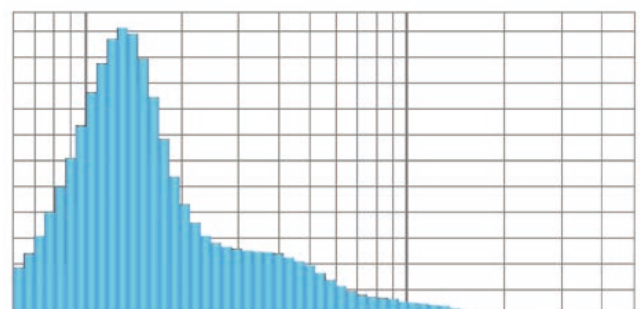
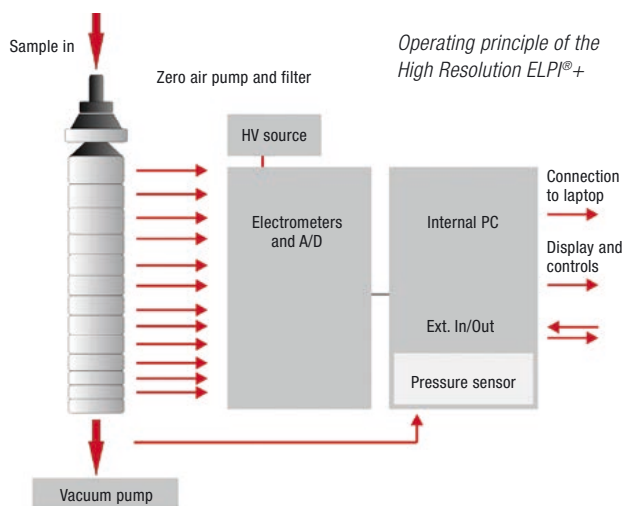
The High Resolution ELPI®+ operating principle is the same as ELPI®+ operation with added data inversion software. First, the particles pass through a unipolar corona charger where they are charged up to a known positive charge level. Second, the particles are size classified

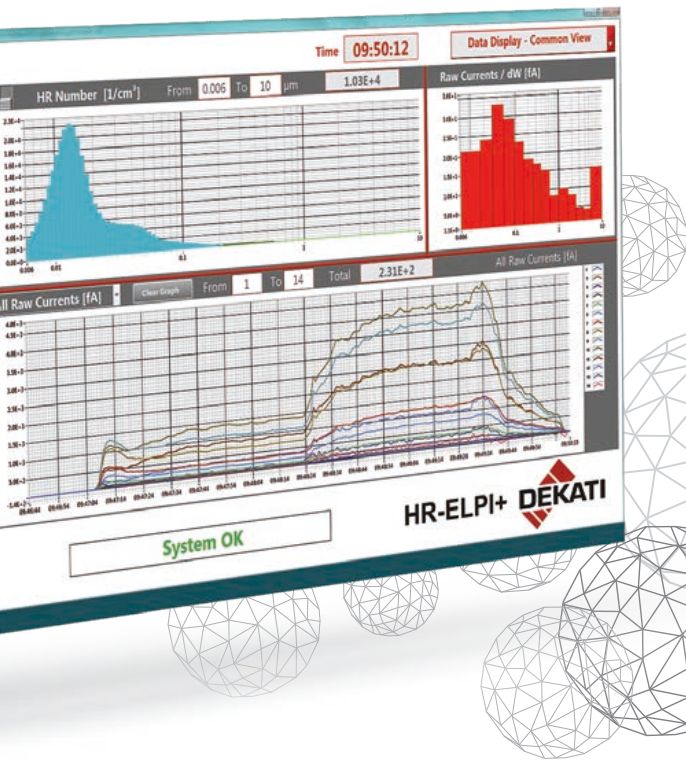
in a cascade impactor into 14 size classes depending on their aerodynamic size. The classification of particles is based on the inertia of the particles, with larger particles getting collected on the upper impactor stages and smaller particles getting collected on the lower stages.

All the impactor stages are electrically insulated from each other and each impactor stage is connected to an electrometer. The primary particle collection efficiencies and the amount of diffusion and image charge deposition have been determined for each impactor stage allowing determination of impactor Kernel functions.\* The data inversion calculation method used in the HR-ELPI®+ is based on these Kernel functions and iterative calculation routines, resulting in an accurate and reliable determination of particle size distribution with high size resolution. The inversion calculation runs in real-time and doesn't require any adjustments nor optimizations from the user of the instrument.

\* Järvinen, A., Aitoma, M., Rostedt, A., Keskinen, J. & Yli-Ojanperä, J. 2014. Calibration of the new electrical low pressure impactor (ELPI+). 2014 J. Aerosol Sci. 69, pp. 150-159.

\* Lemmetty, M., Keskinen, J., and Marjamäki, M. 2005. The ELPI Response and Data Reduction II: Properties of Kernels and Data Inversion. Aerosol Sci. Technol. 39(7):583-95.



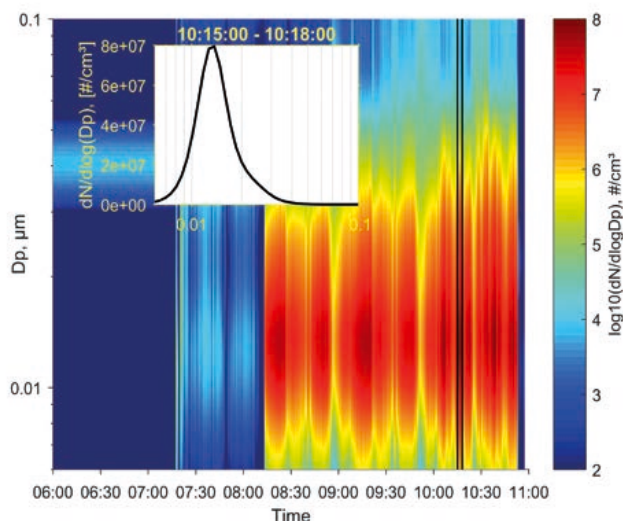


## Measurement Applications

The robust structure of the HR-ELPI<sup>®</sup>+, and its ability to measure in real-time over a wide size range, make the HR-ELPI<sup>®</sup>+ the ideal choice for various measurement applications. In combination with Dekati<sup>®</sup> Sample Conditioning Instruments, Dekati can provide complete HR-ELPI<sup>®</sup>+ measurement solutions for a very broad range of applications and even demanding measurement conditions.

### Typical applications for the HR-ELPI<sup>®</sup>+ include:

- Combustion process studies and emission measurements
- Outdoor and indoor air quality measurements
- Occupational health studies
- Inhalation toxicology
- Engine exhaust measurements
- Brake and tire wear measurements
- Blow-by gas measurements
- Nanoparticle measurements
- Filtration efficiency measurements
- ENDS measurements



3D printer emissions measured with the HR-ELPI<sup>®</sup>+

## Features and benefits

- Wide particle size range 6 nm - 10 μm with one single instrument
- Real-time (10 Hz) particle size distribution in up to 500 size classes
- Particle number, LDSA and mass concentration calculation
- Possibility of post-measurement chemical characterization of size classified impactor samples
- Long-term, maintenance free operation with sintered collection plates
- Wide operational concentration range
- Insensitivity to variations in sample pressure
- Sampling from up to 180 °C with the High Temperature ELPI<sup>®</sup>+ upgrade
- Comes with the new ELPI<sup>®</sup>+ Data Analysis Tool software for easy data processing and visualization
- Simple and robust construction
- Insensitivity to variations in sample pressure
- Sophisticated calibration made for each manufactured unit
- Integrated flow control and pressure adjustment
- ISO16000-34 compliant measurement method for real-time determination of PM indoors

## Accessories

- Aluminium and polycarbonate impactor collection foils, 25 mm
- Collection substrate spray (DS-515) with a stencil (DS-125)
- Vacuum pumps
- Spare impactors and collection plate sets
- Sintered collection plate sets for long-term, maintenance free operation
- High Temperature ELPI<sup>®</sup>+ upgrade for direct hot aerosol sampling up to 180 °C
- Dekati<sup>®</sup> Dilution Systems for conditioning samples from combustion flue gas and automotive exhaust
- Dekati<sup>®</sup> Dryer (DD-600) for removing water from ambient aerosol
- Sample inlets for air quality measurements

# Dekati® High Resolution ELPI®+



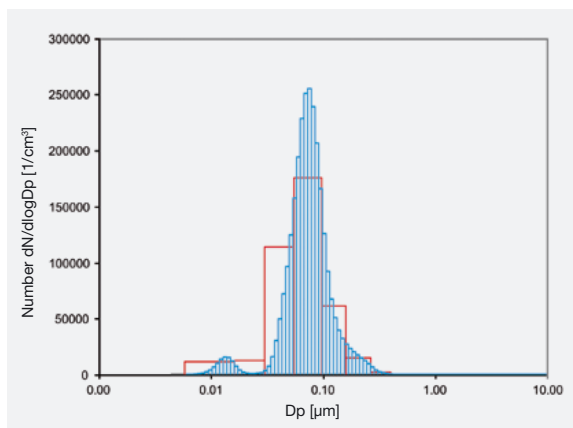
## HR-ELPI®+ Specifications

Particle size range	0.006 - 10 µm
Number of size classes	100 or 500 (30 or 150 per decade)
Sample flow rate	10 lpm
Sensitivity	250 #/cm <sup>3</sup> for 10 nm particles 20 #/cm <sup>3</sup> for 100 nm particles 1.0 #/cm <sup>3</sup> for 1 µm particles 0.1 #/cm <sup>3</sup> for 5 µm particles
Dimensions	H407 x W454 x D242 mm
Collection plate diameter	25 mm
Unit weight	15 kg without impactor 22 kg with impactor in its place
Pump requirements*	20 m <sup>3</sup> /h @ 40 mbars
Sample temperature	10-50 °C 10-180 °C with the High Temperature ELPI®+ upgrade Up to 1200 °C when combined with Dekati® Sample Conditioning Instruments
Sample humidity	0-90 % RH Non-condensing
Sampling rate	10 Hz
Power	100-250 V, 50-60 Hz, 200 W
Computer requirements	MS-Windows 8™, MS-Windows 10™
Connection to PC	RS-232 or Ethernet
6 analogue inputs	0-5 V
3 analogue outputs	0-10 V

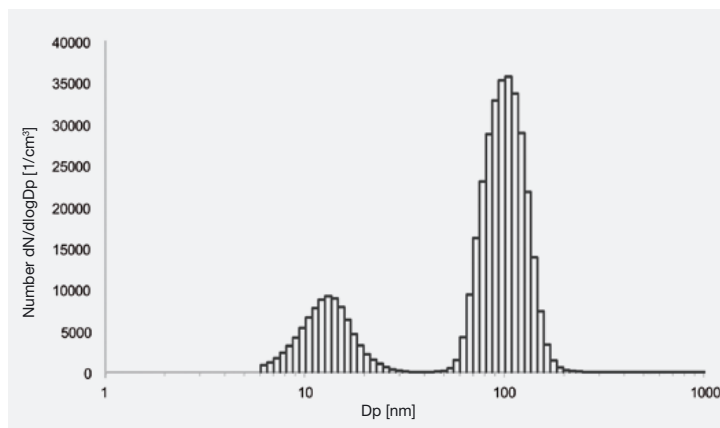
\* Suitable pumps available at Dekati Ltd.



HR-ELPI®+ impactor and charger unit



ELPI®+ data in red, HR-ELPI®+ data in blue colour



Example High Resolution ELPI®+ data

## Acknowledgements

The ELPI® instrument originated through work carried out at the Aerosol Research Group at the Tampere University of Technology, Tampere, Finland.



► **Dekati Ltd.** is a world leader in designing and manufacturing innovative fine particle measurement solutions. We have over 25 years of experience in providing measurement instruments and complete measurement solutions to a wide variety of environments and sample conditions. All Dekati® Products are developed and manufactured in Finland and are available with up to five-year warranty.

