Print View

U-SMPS 1700 X

Universal scanning mobility particle sizer for high concentrations of 4 – 600 nm with integrated X-ray ionization

Description

Fig. 1: U-SMPS 1700 X

The Palas® universal scanning mobility particle sizer (U-SMPS) for high aerosol concentrations is available in two versions. With a **short classification column** (1700 X model variation), the U-SMPS is especially well suited for extremely precise measurements of particle size distributions within the range of 4 to 600 nm.

A soft X-ray source as neutralizer is already integrated (see figure 1). The advantage instead of a radioactive neutralization (for example with Kr-85) is that there is no need in following requirements during the transportation. The Palas® U-SMPS system includes a **classifier** [defined in ISO 15900 as a differential electrical mobility classifier **(DEMC),** also known as a differential mobility analyzer (DMA)], in which aerosol particles are selected according to their electrical mobility and passed to the outlet. The electrical charges carried by these particles are then measured in a downstream **Charme® aerosol electrometer** . A major advantage of aerosol electrometers includes the fact that they enable very rapid measurements. However, this method requires a rather high number of charges. This limits the applicability to high aerosol concentrations (e.g. downstream from a combustion process or particle generator). The measurement of the charge per time unit (flow) is directly traceable to physical parameters. As a result, this method is primarily used as a reference during calibration of condensation particle counters (e.g. UF-CPC). The U-SMPS is operated using a graphical user interface on a touch screen. A single particle distribution scan can be

performed in as few as 30 seconds or in up to 64 size channels per decade, during which the voltage in the DEMC classifier is varied continuously, resulting in higher count statistics per size channel. The integrated data logger allows linear and logarithmic display of the measured values on the device itself. The enclosed evaluation software provides various data evaluation (extensive statistics and averaging) and export capabilities. The U-SMPS is typically operated as a stand-alone device, but can also be connected to a computer or network using various interfaces (USB, LAN, WLAN, RS-232/485). The Palas® U-SMPS universally supports DMAs, CPCs, and aerosol electrometers from other manufacturers. **Accurate size determination and reliable performance of the U-SMPS are extremely important especially for calibrations. All components are required to pass strict quality assurance testing and are assembled in-house.** Figure 2 presents the principle of operation of the U-SMPS:

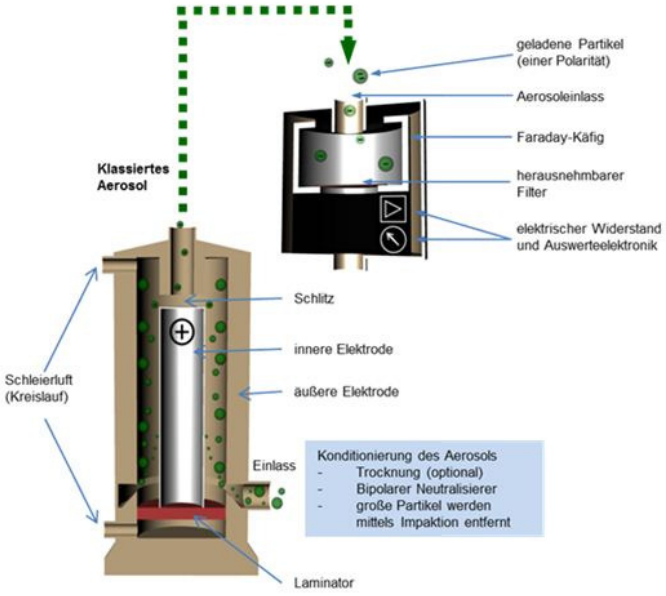

Figure 2: Principle of operation of the universal scanning mobility particle sizer (U-SMPS) with an aerosol electrometer as the concentration measuring device The aerosol is conditioned before it enters the classifier (DEMC column). An optional dryer (e.g. silica gel, Nafion) removes moisture from the particles. A bipolar neutralizer (e.g. Kr 85) is used to ensure a defined charge distribution of the aerosol. An impactor at the inlet of the DEMC is required in order to remove particles larger than the classifier size range. The aerosol is then directed into the DEMC column via the inlet. The aerosol flow along the outer electrode is carefully combined here with a sheath air flow. It is important to avoid any turbulence here in order to ensure laminar flow. The surfaces of the electrodes must be of extremely high quality with respect to smoothness and tolerances. This sheath air is a dry, particle-free carrier gas (typically air) with a higher volume than the aerosol that is continuously circulated in a closed loop. The sheath air to sample air volume ratio defines the transfer function and thus the resolution capacity of the DEMC.

A radially symmetric electric field is generated between the inner and outer electrode by applying voltage. The inner electrode is positively charged with a small slit at the end. By balancing the electrical force on each particle with its aerodynamic drag force in the electrical field, negatively charged particles are diverted to the positive electrode. Depending on their electrical mobility, some of the particles pass through the slit and exit the DEMC. In operation, the voltage and thus the electrical field change continuously. As a result, particles with varying mobility exit the DEMC and are measured consecutively by a nanoparticle counter – shown here as an aerosol electrometer (e.g. Palas® Charme®). A back-transformation is necessary in order to combine the data (voltage, charge number, charge distribution, etc.) and obtain a particle size distribution. The algorithm used for this purpose was developed by Prof. Wiedensohler from the IfT (Leipzig, Germany).

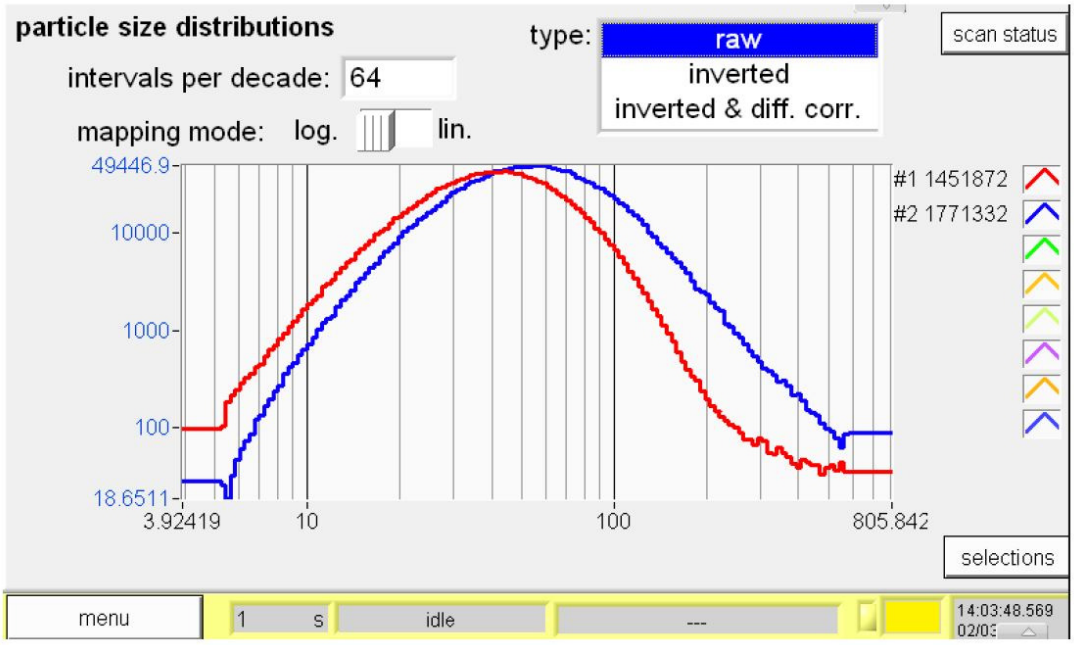

Figure 3: Particle size distributions of an aerosol generated by the Palas® DNP 3000 particle generator on the touch screen **User interface and software** Based on continuous customer feedback, the user interface and software have been designed for intuitive operation and real-time control and display of measurement data and parameters. In addition, the software provides data management with the integrated data logger, sophisticated export capabilities, and network support. The measured data are able to be displayed and evaluated with many available options. **Available systems** Figure 4 presents the two combinations of the DEMC and Charme® aerosol electrometer available from Palas® . For combinations of the DEMC classifier with Palas® condensation particle counters, please read the "U-SMPS 1xx0_2xx0_V0011212" data sheet. Most DMAs, CPCs, and aerosol electrometers from other manufacturers are able to be used as components of the U-SMPS system.

U-SMPS 1700 X

Universal Scanning Mobility Particle Sizer	U-SMPS 1700
Differential Electrical Mobility Classifier	DEMC 1000
	Partikelgrößenbereich: bis 350 nm
	Anzahl der Größenkanäle: 1 – 64 / Dekade
Referenz Aerosol Elektrometer	Charme®
Messbereich	± 1 fA bis 22.500 fA
Maximaler Konzentrationsbereich (1/cm³)	Abhängig von der Größe z. B. für 3 nm 1,6 x 10^7
Universal Scanning Mobility Particle Sizer	**U-SMPS 2700**
Differential Electrical Mobility Classifier	DEMC 2000
	Partikelgrößenbereich: bis 1.200 nm
	Anzahl der Größenkanäle: 1 – 64 / Dekade
Referenz Aerosol Elektrometer	Charme®
Messbereich	± 1 fA bis 22.500 fA
Maximaler Konzentrationsbereich (1/cm³)	Abhängig von der Größe z. B. für 3 nm 1,6 x 10^7

Figure 4: Overview of the Palas® U-SMPS systems for high concentrations

U-SMPS 1700 X

Benefits

- Particle size distributions from 2 to 400 nm
- Continuous and fast-scanning principle of measurement
- High resolution in up to 128 size classes/decade
- Suitable for concentrations of up to10^8 particles/cm^3
- Universally connects to DMAs and nanoparticle counters from other manufacturers
- Graphic display of measurement values
- Intuitive operation using 7" touchscreen and GUI
- Integrated data logger
- Supports multiple interfaces and remote access
- Low maintenance
- Reliable function
- Reduces your operating expenses

U-SMPS 1700 X

Datasheet

Parameter	*Description*
Measurement range (size)	2 – 400 nm
Size channels	up to 256 (128/decade)
Measurement range (number C_N)	0 – 10^8 particles/cm^3
User interface	Touch screen, 800 • 480 pixels, 7" (17.78 cm)
Data logger storage	4 GB
Software	PDAnalyze
Adjustment range (voltage)	1 – 10,000 V
Volume flow (sheath air)	2.5 – 14 l/min
Installation conditions	+5 – +40 °C (control unit)
Neutralizer	XRC 049

U-SMPS 1700 X

Applications

- Filter test
- Aerosol research
- Inhalation experiments
- Workplace measurements

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