U-SMPS 1700

Palas® U-SMPS (Universal Scanning Mobility Particle Sizers) have been successfully used worldwide for many years for the precise selection of particle size with simultaneous measurement of the particle concentration of airborne particles in the sub-micron range. They make an essential contribution to research/development as a measuring instrument for determining the efficiency of filter media and elements and in the environmental field for determining the concentration and size of ultrafine particles.

Depending on the combination of classifying column (DMA), control unit (DEMC), and particle counter, they cover ranges from a few nanometers to several micrometers. Different combinations are possible depending on the application and customer requirements.

The maximum possible resolution is 128 channels/decade. Combined with an optical particle counter, the upper limit can be extended to 40 μm (U-Range System: U-SMPS System + Fidas® System or Promo® System).

Palas® U-SMPS System can be operated directly with max. two different counters and also accepts third-party products of well-known manufacturers for direct comparison.

Model Variations

U-SMPS 1700 X

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

OPERATION PRINCIPLE

UNIVERSAL SCANNING MOBILITY PARTICLE SIZER FOR HIGH CONCENTRATIONS OF 2 – 400 NM

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 charge per time unit (flow) measurement is directly traceable to physical parameters. As a result, this method is primarily used as a reference during the 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 128 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 1 presents the principle of operation of the U-SMPS:

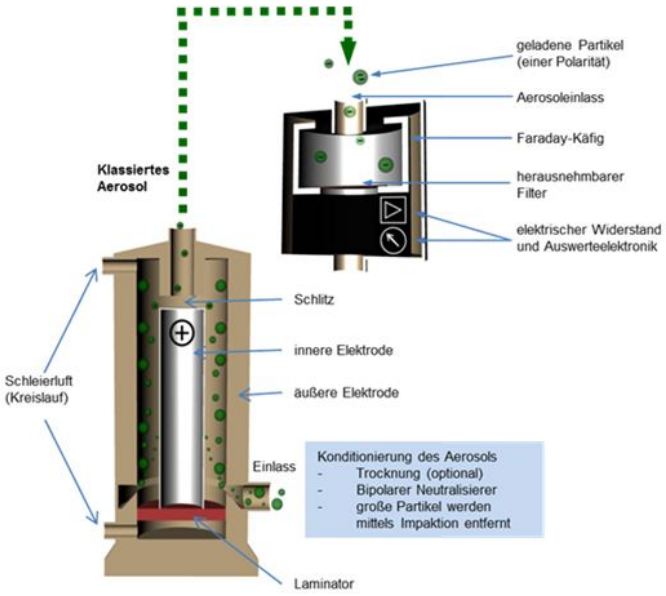

Figure 1: Principle of operation of the universal scanning mobility particle sizer (U-SMPS) with an aerosol electrometer as the concentration measuring device

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 DEMC's inlet is required 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 turbulence here 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 electrodes 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. Prof. Wiedensohler developed the algorithm used for this purpose from the IfT (Leipzig, Germany).

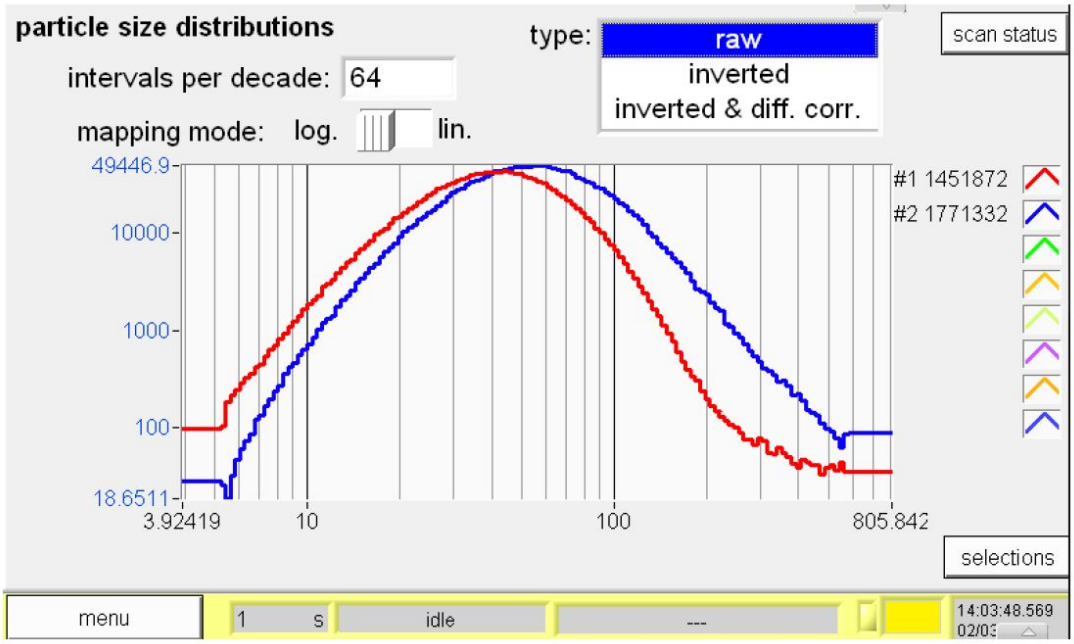

Figure 2: Particle size distributions of an aerosol generated by the Palas® DNP 3000 particle generator on the touch screen

Based on continuous customer feedback, the user interface and software have been designed for intuitive operation, real-time control, and display of measurement data and parameters.

In addition, the software provides data management with an integrated data logger, sophisticated export capabilities, and network support. The measured data are able to be displayed and evaluated with many available options.

Figure 3 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.

Universal Scanning Mobility Particle Sizer	**U-SMPS 1700**
Differential Electrical Mobility Classifier	DEMC 1000
	Particle size range: bis 350 nm
	Number of size channel: 1 – 64 / Dekade
Reference Aerosol Electrometer	**Charme®**
Measuring range	+- 1fA bis 22,500 fA
Max. concentration range (1/cm^3)	Depending on the size e. g. for 3 nm 1.6 x 10^7
Universal Scanning Mobility Particle Sizer	**U-SMPS 2700**
Differential Electrical Mobility Classifier	DEMC 2000
	Particle size range: up to 1,200 nm
	Number of size channel: 1 – 64 / decade
Reference Aerosol Electrometer	**Charme®**
Measuring range	+- 1 fA up to 22,500 fA
Max. concentration range	Depending on size e. g. for 3 nm 1.6 x 10^7

Table 2: Overview of the Palas® U-SMPS system for high concentration

Figure 3: Overview of the Palas® U-SMPS systems for high concentrations

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

DATASHEET

Measurement range (number C_N)	10^5 – 10^8 Partikel/cm^3
Measurement range (size)	2 – 440 nm
Volume flow (sheath air)	2.5 – 14 l/min
Size channels	Max. 256 (128/decade)
User interface	Touchscreen, 800 • 480 pixel, 7″ (17.78 cm)
Data logger storage	4 GB
Software	PDAnalyze
Installation conditions	+5 – +40 °C (andere auf Anfrage)
Adjustment range (voltage)	1 – 10,000 V
Data Management	Prepared for connection to the Palas®Cloud MyAtmosphere (″MyAtmosphere-ready″); internet access and separate registration required.MyAtmosphere terms and conditions of use apply.

APPLICATIONS

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

Mehr Informationen:
https://www.palas.de/product/usmps1700