

U-SMPS 1050/1100/1200 & 2050/2100/2200



Universal Scanning Mobility Particle Sizer for a wide range of applications



Figure 1: U-SMPS 1050 / 1100 / 1200



Figure 2: U-SMPS 2050 / 2100 / 2200

The Palas® Universal Scanning Mobility Particle Sizer – U-SMPS is available in two different models. The U-SMPS with the **short classifying column** (models **1xx0**) is particularly suitable for very precise measurements of particle size distributions in the size range of 4 nm to 600 nm. The one with the **long classifying column** (models **2xx0**) enables the reliable determination of particle size distributions between 8 nm and 1,200 nm.

The Palas® U-SMPS system consists of a classifier (defined in ISO 15900 as Differential Electrical Mobility Classifier – **DEMC**; also known as Differential Mobility Analyzer – DMA), in which aerosol particles are selected according to their electrical mobility and passed to its exit.

These particles are then counted by a condensation particle counter (e. g. Palas® **UF-CPC**). The three different UF-CPC models available enable optimised single particle counting in various concentration ranges. A well-known and optimized algorithm inverts the measured data to yield the particle size distribution. For the Palas® U-SMPS, Prof. Wiedensohler (IfT Leipzig, Germany) has supplied the algorithm for the SMPS data inversion.

The U-SMPS is operated through a graphical user interface on a large touchscreen. A scan of the particle size distribution can be performed in as few as 30 seconds or in as many as 64 size channels per decade. During a scan, the voltage in the DEMC is varied continuously, not in steps, which results in higher count statistics per size channel. The integrated data logger enables linear and logarithmic display of measurement values and data management on the device itself. The enclosed evaluation software provides sophisticated data evaluation (extensive statistics and averaging) and export possibilities.

The U-SMPS is typically operated stand-alone but can be connected to a computer or network by several interfaces (USB, WLAN, LAN, RS232/485). The Palas® U-SMPS universally connects to DMAs, CPCs and aerosol electrometers from other manufacturers.

Especially for calibration setups accurate sizing and reliable performance of the U-SMPS is extremely important. All components have to pass a strict quality assurance test and are assembled in-house.

Particular advantages:

- Aerosol particle size distributions from 4 nm to 1.2 µm
- Continuous and fast-scanning operation principle
- High resolution of up to 64 size channels/decade
- Can be used for concentrations up to 10⁸ particles/cm³
- Universally connects to DMAs and nanoparticle counters from other manufacturers*
- Graphic representation of measurement values
- Intuitive operation via 7" touchscreen and GUI
- Integrated data logger
- Supports multiple interfaces and remote operation
- Low maintenance
- Reliable function
- Reduces your operating costs

Application examples:

- Filter testing
- Aerosol research
- Environmental & climatic studies
- Inhalation & exposure studies
- Indoor & workplace air quality measurements

Technical parameters:

U-SMPS:

- Particle size range: U-SMPS 1xx0: dp = 4 nm – 600 nm
U-SMPS 2xx0: dp = 8 nm – 1,200 nm
- Number of size channels: 1 – 64 per decade
- Concentration range: up to 10⁸ particles/cm³
- Flow sample / sheath air: 0 – 4 l/min / 0 – 10 l/min
- User interface: Touchscreen 800 x 480 pixels
1.6 GHz Intel Atom™ processor
2 GB Compact Flash
- Interfaces: USB, LAN, WLAN, RS-232/485
- Power supply: 115/230 V; 50/60 Hz
- Dimensions control unit: 33 x 38 x 24 cm (HxWxD)
- Dimensions column: 15 x 57 cm (ø base x H)
- Weight control unit: 12.9 kg
- Weight column: 9.3 kg

UF-CPC:

- Particle size range: dp = 4 nm – 10.000 nm
- Concentration range:
 - UF-CPC 50 $C_{Nmax} \leq 2,000 P/cm^3$ (single counting)
 $C_{Nmax} < 10^7 P/cm^3$ (photometric mode)
 - UF-CPC 100 $C_{Nmax} \leq 50,000 P/cm^3$ (single counting)
 $C_{Nmax} < 10^7 P/cm^3$ (photometric mode)
 - UF-CPC 200 $C_{Nmax} \leq 1,000,000 P/cm^3$ (single counting)
 $C_{Nmax} < 10^7 P/cm^3$ (photometric mode)
- Concentration accuracy: 5 % (single counting)
10 % (photometric mode)
- Working fluid: butanol, isopropanol, water or others
- Aerosol flow rate: adjustable between 0.30 and 0.60 l/min
- Dimensions (HxWxD): 33 x 38 x 24 cm
- Weight: 10 kg

Accessories:

- Aerosol neutralizer Kr-85
- Transport case

* Please contact Palas® for further details.

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PALASCOUNTS

U-SMPS

Quality in detail

Figure 3 is a schematic diagram of the working principle of the U-SMPS. Before the aerosol enters the size classifier (DEMC column), it is conditioned. 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 used to remove particles larger than the classifier size range.

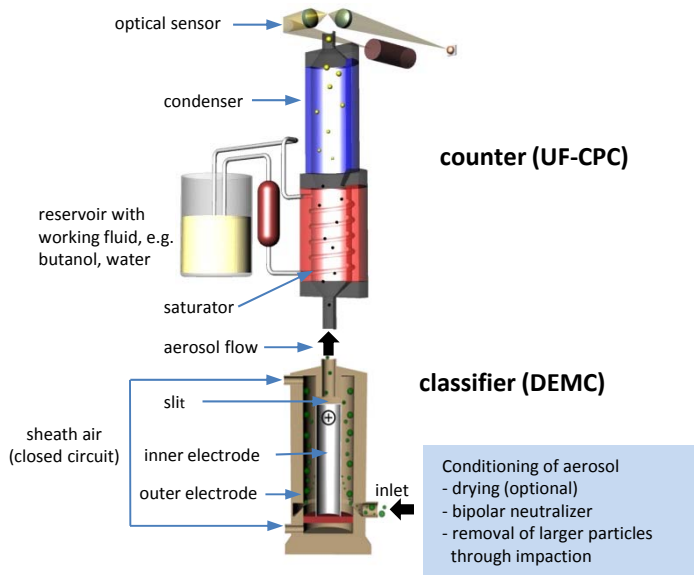


Figure 3: working principle of the Universal Scanning Mobility Particle Sizer (U-SMPS)

Subsequently, the aerosol enters the DEMC column through the inlet. The aerosol flow along the outer electrode is then carefully combined with a sheath air flow. It is important to avoid any turbulence and ensure laminar flow. The surfaces of the electrodes need to be of extremely high quality in regards to smoothness and tolerances.

The sheath air is a dry particle free carrier gas (typically air) that is continuously circulated in a closed loop and of a higher volume than the aerosol. The ratio between sheath air volume to sample air volume defines the transfer function and therefore the resolution of the DEMC.

By applying a voltage, a radial symmetric electrical field between the inner and outer electrode is created. The inner electrode is kept at a positive potential and disposes of a small slit at the top 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. Based on their electrical mobility, some particles will traverse the slit and be able to exit the DEMC.

In operation, the voltage and consequently the electrical field is continuously changed and at different times particles of different mobility are exiting the DEMC and are successively counted by a submicron particle counter such as a condensation particle counter (e.g. Palas® UF-CPC).

In order to combine data (voltage, particle number, etc.), the well-proven software offers special advantages to produce a particle size distribution, as shown in figure 4.

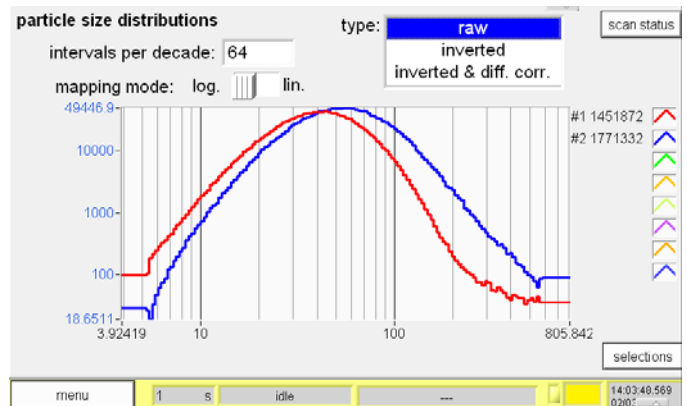


Figure 4 : Particle size distribution of the output of a Palas® DNP 3000 particle generator

User interface and software:

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

The user interface also provides data management with the integrated data logger, various export possibilities and network support. With the software the measured data can be displayed and evaluated with many options available.

Available systems:

Figure 5 shows the different combinations of DEMC and counters offered by Palas®. Moreover, the Palas® U-SMPS supports universal DMAs, CPCs and aerosol electrometers from other manufacturers.

Universal Scanning Mobility Particle Sizer		U-SMPS 1050	U-SMPS 1100	U-SMPS 1200
Differential Electrical Mobility Classifier		DEMC 1000		
		Size range: 4 nm – 600 nm		
		Number of size channels: 1 – 64 / decade		
Universal Fluid Condensation Particle Counter		UF-CPC 50	UF-CPC 100	UF-CPC 200
Maximum number concentration (1/cm ³)	Single particle counting	2,000	50,000	10 ⁶
	Photometric count mode	10 ⁷	10 ⁷	10 ⁷
Universal Scanning Mobility Particle Sizer		U-SMPS 2050	U-SMPS 2100	U-SMPS 2200
Differential Electrical Mobility Classifier		DEMC 2000		
		Size range: 8 nm – 1,200 nm		
		Number of size channels: 1 – 64 / decade		
Universal Fluid Condensation Particle Counter		UF-CPC 50	UF-CPC 100	UF-CPC 200
Maximum number concentration (1/cm ³)	Single particle counting	2,000	50,000	10 ⁶
	Photometric count mode	10 ⁷	10 ⁷	10 ⁷

Figure 5: Overview of the Palas® U-SMPS systems

Palas® is continuously setting standards in aerosol technology with more than 50 patents filed since 1983. Our innovations result in products of superior quality and long durability, which lead to unique technical and economic advantages for our customers.

On this account, Palas® could established itself as a world-wide market leader in aerosol generation, aerosol dilution and aerosol particle measurement.