



Differential electrical mobility classifier from 4 – 600 nm with integrated X-ray ionization

## Description



Fig. 1: DEMC 1000 X

The Palas® DEMC is available in two versions. The version with the short classifying column (1000 model) is suitable for the size 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 DEMC size classifier (as defined in ISO 15900) selects aerosol particles based on their electrical mobility and directs them to the outlet. The DEMC is also often referred to as a DMA.

The Palas® DEMC universally connects to CPCs and aerosol electrometers from other manufacturers. Several counters are already supported (see Figure 4). We will also integrate your counter into the software upon request.

In combination with a polydisperse particle source\*, a DEMC is used to obtain a very narrow (monodisperse) particle size distribution for nanoparticles of a certain size.

Accurate size determination and reliable performance of the DEMC are extremely important especially for calibration set-ups. The size is adjusted by entering it directly on the touch screen (in nm) or by using the arrow buttons to increase or decrease the size.

If the DEMC is used as a component of an SMPS system, it provides continuous and rapid scanning of the particle size distribution of the aerosol. Based on the user settings, a scan can be performed in as few as 30 seconds or in up to 64 size channels per decade.

The user controls the DEMC using a graphical user interface, which provides linear and logarithmic display of measurement values and data management of the integrated data logger. The software provides sophisticated data evaluation (extensive statistics and averaging) and export capabilities.

The DEMC 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).

\* Additional information can be found in the product data sheets for the aerosol generators by Palas®, e.g. the DNP 2000, RBG 1000 or AGF 2.0.

## Function

Figure 2 presents the principle of operation of the DEMC. The aerosol is conditioned before it enters the DEMC column. A dryer (e.g. silica gel, Nafion) removes moisture from the particles. A bipolar neutralizer (XRC 370) 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.

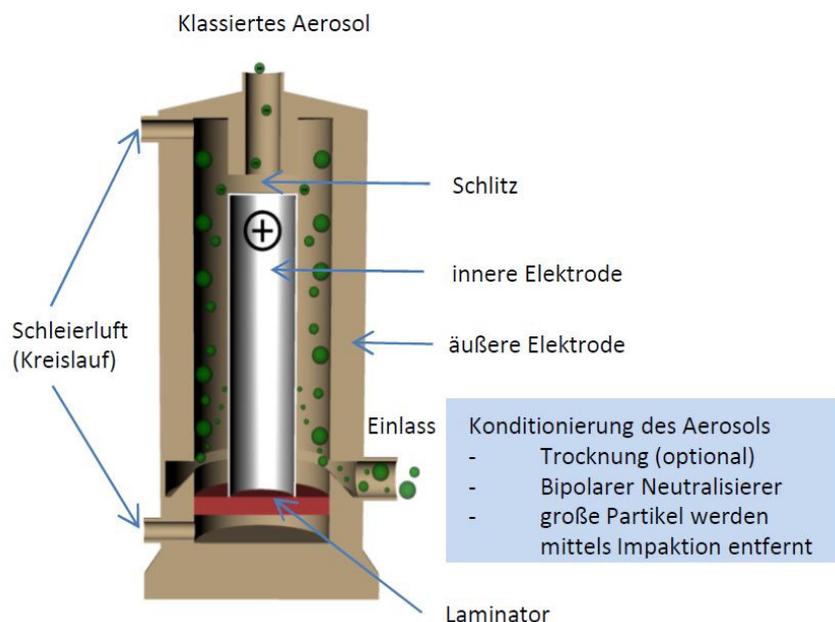


Fig. 2: Principle of operation of the DEMC

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. Particles with appropriate electrical mobility pass through the slit and exit the DEMC. These classified particles with the same electrical mobility are then available for use downstream.

If the DEMC is used as a component of an SMPS system, then the voltage and thus the electrical field change continuously. Particles of varying mobility exit the DEMC and are counted consecutively by a nanoparticle counter and a condensation particle counter (e.g. Palas® UF-CPC) or an aerosol electrometer (e.g. Palas® Charme®). The tested and optimized Palas® software combines the data (voltage, particle number, etc.) in order to obtain a particle size distribution, as shown in Figure 3.

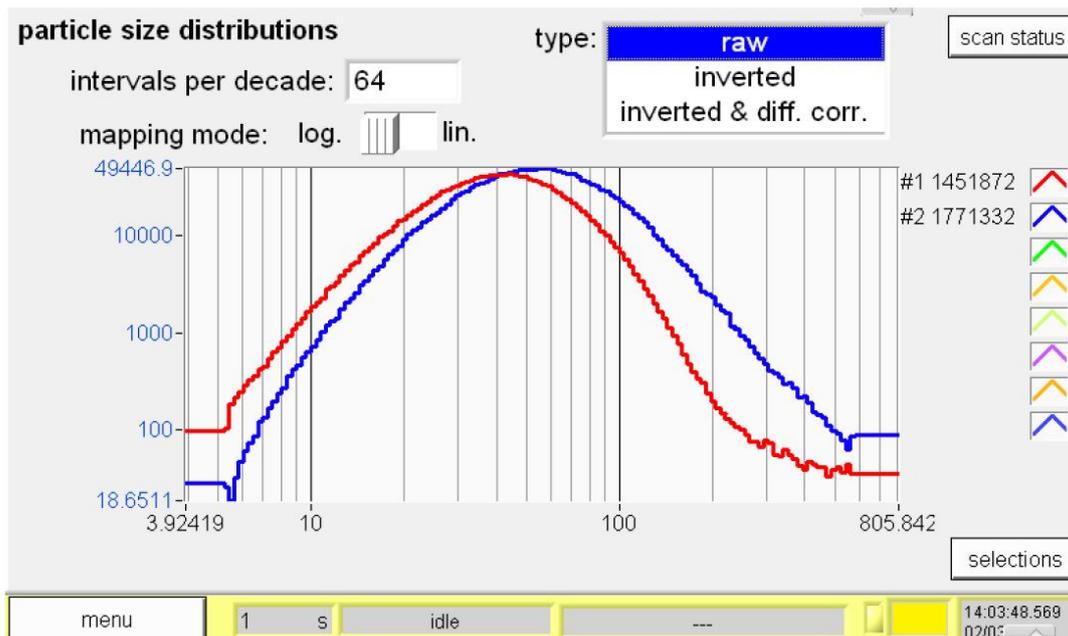


Fig. 3: Particle size distributions of an aerosol generated by the Palas® DNP 3000 particle generator

### 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. The DEMC software and firmware support the use of nanoparticle counters by other manufacturers. Figure 4 presents an example.

**counter status**

| selection for scan #1               | selection for scan #2               | DAQ activated                       |  |                      |                  |                   |                                    |
|-------------------------------------|-------------------------------------|-------------------------------------|--|----------------------|------------------|-------------------|------------------------------------|
| <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <b>UF-CPC#1</b>                              | device connected     | device ready     | IP: 192.168.0.186 | 1224 P/cm <sup>3</sup> 0,504 l/min |
| <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <b>Charme</b>                                | device not connected |                  | COM1              | 0 P/cm <sup>3</sup> 0 l/min        |
| <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <b>TSI CPC</b><br>3775,3776<br>3025A<br>3010 | device connected     |                  | COM1              | 1243 P/cm <sup>3</sup> 0,3 l/min   |
| <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <b>UF-CPC#2</b>                              | device not connected | device not ready | IP: 192.168.0.186 | 0 P/cm <sup>3</sup> 0 l/min        |

menu | 12,0 s | auto | 21:01:00,000 | 12.12.2012

Fig. 4: Screenshot of DEMC counter selection

## Benefits

- The user is able to select any size within the defined size range.
- The DEMC can be connected to many counters to form an SMPS.
- Continuous and fast-scanning principle of measurement
- Graphic display of measurement values
- Intuitive operation using 7" touchscreen and GUI
- Integrated data logger
- Low maintenance
- Reliable function
- Reduces your operating expenses

## Datasheet

| <i>Parameter</i>                  | <i>Description</i>                               |
|-----------------------------------|--|
| <b>Size channels</b>              | up to 256 (128/decade)                           |
| <b>User interface</b>             | Touch screen, 800 • 480 pixels, 7"<br>(17.78 cm) |
| <b>Data logger storage</b>        | 4 GB   |
| <b>Software</b>                   | PDAnalyze  |
| <b>Classifying range (size)</b>   | 4 - 607 nm                                       |
| <b>Adjustment range (voltage)</b> | 1 - 10,000 V                                     |
| <b>Volume flow (sheath air)</b>   | 2.5 - 14 l/min                                   |
| <b>Impactor</b>                   | Nozzle for 3 different cut-offs                  |
| <b>Installation conditions</b>    | +5 - +40 °C (control unit)                       |
| <b>Neutralizer</b>                | XRC 370  |

## Applications

- Calibration of condensation particle counters (CPC)
- Monodisperse particle source
- System component of an SMPS

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