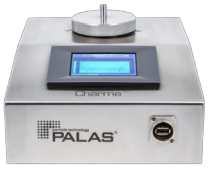
CHARME®



Charme® is a high-capacity Faraday cup aerosol electrometer that measures the electrical charges on aerosol particles. For years, aerosol electrometers have been used in research applications to measure the mean charge of an aerosol. If the charge state of the particles for monodisperse aerosols is known, then these devices can quickly and easily determine the number concentration of particles with an approx. size ≥ 2 nm.

An on-site correlation between the measured current (particle charges) and the mass concentration can be determined using a gravimetric filter, which the user can switch out. As a result, the Charme® aerosol electrometer is particularly well suited for verifying high particle loads in the environment and in the workplace, as well as for calibrating condensation particle counters (CPCs).

OPERATION PRINCIPLE

DETERMINATION OF THE ELECTRICAL CHARGE OF ULTRAFINE AEROSOLS FROM 2 NM TO 10 µM

For polydisperse aerosols, a charger or neutralizer is often used to establish a defined charge distribution. When a particle size is selected with an upstream classifier (e.g., Palas DEMC), the particle number concentration can be determined indirectly through current measurements (charge per unit time). Aerosol electrometers are frequently employed to calibrate condensation particle counters (e.g., Palas UF-CPC). Although there is no absolute standard for particle number concentration, current measurements are directly traceable to SI units. As a result, condensation particle counters can be calibrated by comparing their counting results with those obtained from an aerosol electrometer.

Figure 1 presents the principle of operation of the Charme® aerosol electrometer. A removable gravimetric and electro-conductive filter is installed in a Faraday cage, and the electrically charged particles are collected on the filter. The charges carried by the particles are discharged through a very high resistance. The drop in voltage through this resistance is a measure of the discharging current.

This measured current is converted into a concentration based on the determined number of charges per particle. The measured current and the calculated concentration are shown on the display.

$$C_n = \frac{I}{n \cdot e} \cdot \frac{1}{\dot{V}}$$

C_n = Number concentration

I = Discharging current

n = Mean charge number of the individual particles

e = 1.602176487 • 10^{-19} C elementary charge

V = Volume flow

Measurement accuracy of the Charme® aerosol electrometer:1 fA = 0.000000000000001 A = 10^{-15} A = 6240 elementary charges/s

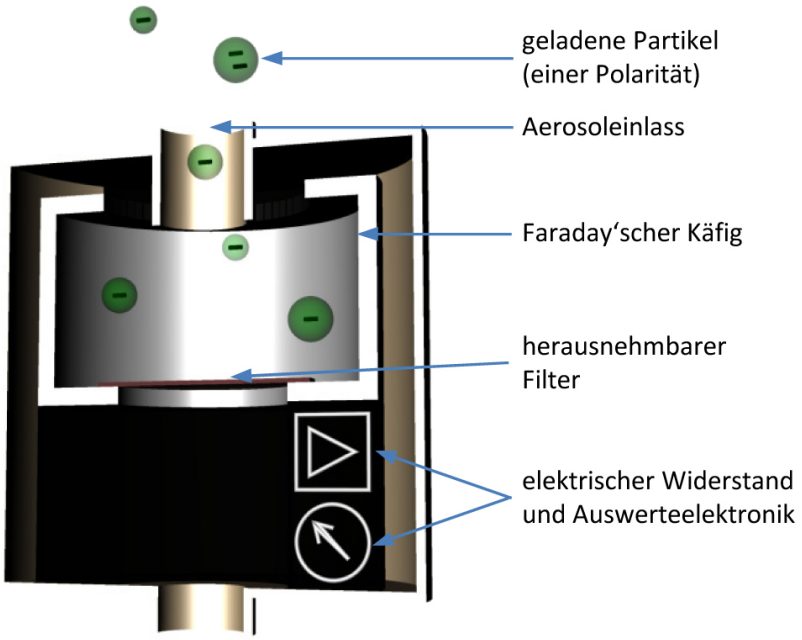


Fig. 1: Principle of operation of the Charme® aerosol electrometer

Due to intrinsic electronic noise, a minimum concentration of charges (particles) must always exist for a meaningful measurement with an aerosol electrometer.

As a result, an aerosol electrometer is unsuitable for measurements at low concentrations, for example, in operating rooms.

The Charme® aerosol electrometer uses an intuitive graphical user interface with a touch screen. The measured values, i.e., electrometer current and particle concentration, are graphically displayed during measurement (see example in Figure 2). Several interfaces ensure the easy export and further use of the obtained data.

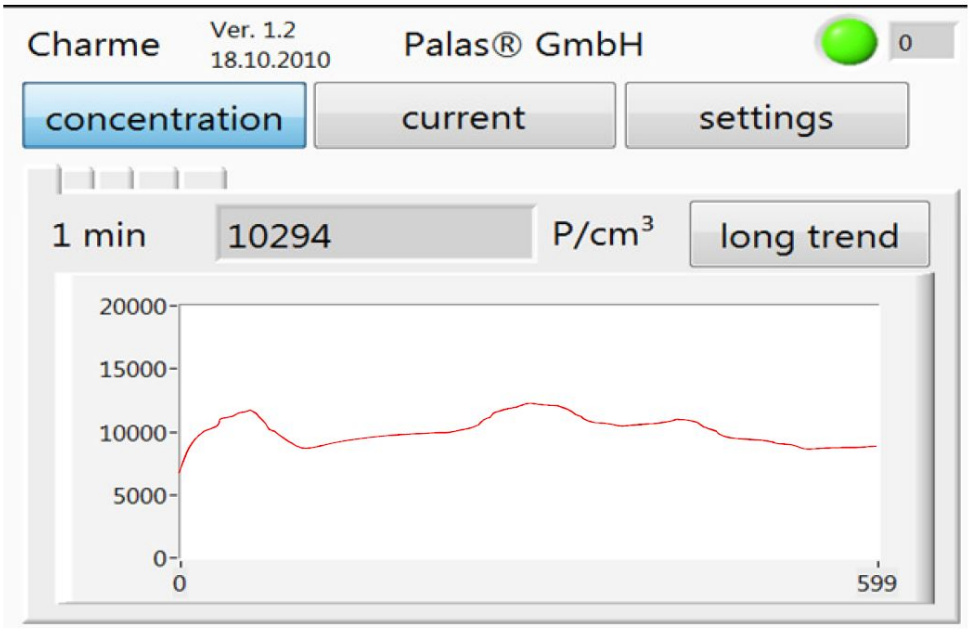


Fig. 2: 1-minute run (600 data points at 10 Hz) of the particle number concentration

BENEFITS

- Reliable current measurement (charge/time) for aerosols
- Quick measurement (10 Hz) of the particle concentration
- Intuitive operation using touch screen
- Graphical display of measured values for particle concentration and electrometer current
- Gravimetric filter that can be switched out for on-site correlation between the measured current and the mass concentration
- Integrated pump
- Integrated data logger
- Low maintenance
- Easy to operate
- Reduces your operating expenses

DATASHEET

Measurement range (number C_N)	1,000–1.6 • 10^7 particles/cm^3
Measurement range (size)	> 2 nm
Volume flow	1 – 5 l/min (internal pump) 1 – 10 l/min (external pump)
Interfaces	USB, Ethernet (LAN), RS-232
Data logger storage	10 MB
Data acquisition	24 bit AD-converter
Measurement range (current)	1 fA – 22,500 fA
Power supply	19 V
Accuracy	0.1 fA (0.1 Hz), 1 fA (1 Hz)

APPLICATIONS

- Aerosol research
- Environmental measurements (high concentrations)
- Workplace measurements
- Emission studies
- Process control
- Calibration of condensation particle counters (CPC)

Mehr Informationen:
https://www.palas.de/en/product/modelcharme