# UF-CPC 50 / 100 / 200

## Universal Fluid Condensation Particle Counter

### Nanoparticle counter for particle number concentrations in aerosols up to $10^7$ P/cm³ in the range of 4 nm up to 10 µm


The Palas® **condensation particle counter UF-CPC** is available in three models, each of them being optimized for a different concentration range. Model 50 is optimized for low concentrations (e.g. after a filter or in an hospital operating room), whereas model 100 is appropriate for medium concentrations (e.g. ambient monitoring). Model 200 offers single particle counting up to 1,000,000 particles/cm³ (e.g. for printer emission studies).

The UF-CPC measures the total number concentration of ultrafine- and nanoparticles suspended in air or gases. These particles are enlarged via condensation – a process, in which the supersaturated vapour of the working fluid transitions to form droplets around the particles that act as condensation nuclei. These resulting droplets are large enough to be detected optically. The condensation process is influenced by the nanoparticles themselves as well as the working fluid, the operation temperatures and the volume flow.

Besides counting, the UF-CPC also measures the size of the droplets thus providing the user with feedback about the condensation process. The novel and patented (US Patent No.: US 7,543,803 B2) way in which the working fluid in the UF-CPC is provided leads to a high flexibility in the choice of working fluid. The user is no longer limited to butanol or water but can additionally opt for a more environmental-friendly or better suited liquid.

As the unit design is modular, most maintenance tasks (e.g. cleaning, pump replacement) can be accomplished by the user and does not require him to send the unit back for service.

For research purposes, the user can – via the advanced menu – change most parameters, e.g. temperature setting of the saturator, with the touch of a button on the big 7“ touch screen.

For process control applications the UF-CPC supports a standardized interface with different protocol choices, e.g. Modbus, and features like remote access and data storage in the internet or in an internal network.

### Particular advantages:

- The unique, patented way of providing the working fluid for condensation allows the user to quickly exchange the working fluids himself (butanol, isopropanol or water)
- Depending on the sensor used (exchangeable by the user), the UF-CPC counts up to 1,000,000 P/cm³ in count mode
- Integrated computer with 7'' touch screen
- Intuitive user interface with sophisticated software for data evaluation
- Integrated data logger
- Limitless integrated network connectivity that supports remote operation and data storage in the internet
- Integrated interface for process control applications

### Perfectly suited for:

- Aerosol research
- Test of filters and air cleaners
- Environmental measurements
- Work place safety and exposure studies
- Inhalation and health effect studies
- Process monitoring
- Printer emission studies

### Technical parameters:

| | | |
|---|---|---|
| • Particle size range: | | dp = 4 nm – 10,000 nm |
| • Concentration range: | | |
| | UF-CPC 50 | $C_{Nmax} \leq 2{,}000$ P/cm³ (single counting) |
| | | $C_{Nmax} < 10^7$ P/cm³ (photometric mode) |
| | UF-CPC 100 | $C_{Nmax} \leq 50{,}000$ P/cm³ (single counting) |
| | | $C_{Nmax} < 10^7$ P/cm³ (photometric mode) |
| | UF-CPC 200 | $C_{Nmax} \leq 1{,}000{,}000$ P/cm³ (single counting) |
| | | $C_{Nmax} < 10^7$ P/cm³ (photometric mode) |
| • Concentration accuracy: | | 5 % (single counting) |
| | | 10% (photometric mode) |
| • Response time: | | $t_{90}$ = 3 s |
| • Working fluid: | | Butanol, isopropanol, water or other |
| • Aerosol flow rate: | | Adjustable 0.30 to 0.60 L/min |
| • Digital single signal detection: | | 20 MHz processor, 256 raw data channels |
| • Light source: | | High stability, long life LED |
| • Operation terminal: | | Touch screen 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 (HxWxD): | | 33 x 38 x 24 cm (13 x 15 x 9.5 in) |
| • Weight: | | 10 kg (22 lbs) |

### Accessories:

- Transport case
- Replacement vials for working fluid

# UF-CPC 50 / 100 / 200
## Quality in detail

Figure 1 shows the principle of operation of the UF-CPC [1].
The aerosol with nanoparticles enters the UF-CPC at the bottom and first enters the heated evaporation chamber – the **saturator**.

Within the saturator the working fluid is moved helically around the flow area of the aerosol leading to a more homogeneous contact area compared to designs where only one or two walls of the saturator are lined with a porous material that is soaked with the working fluid.

Further, the working fluid is circulated continuously from the reservoir to the constantly heated helical U-shaped channel and back to the reservoir with a flow rate that can be adjusted to accomodate different working fluids.

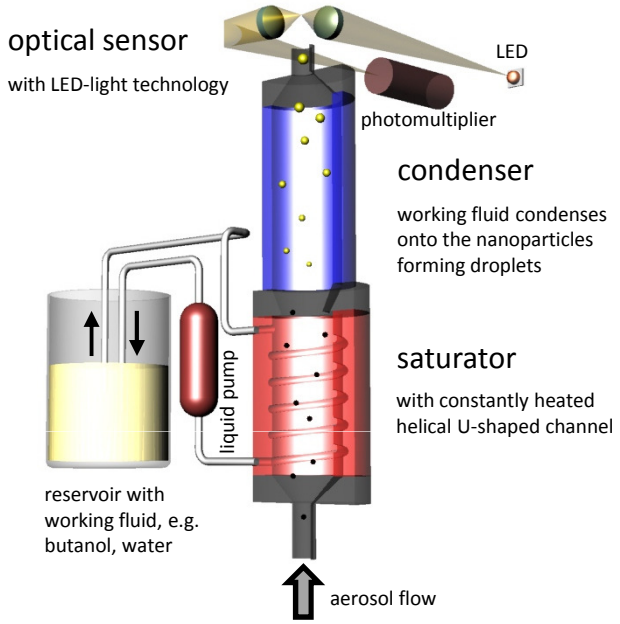


Figure 2: Working principle of the universal fluid condensation particle counter (UF-CPC)

Downstream of the evaporation chamber the aerosol and the saturated carrier gas enter a cooled region - the **condenser** - in which the working fluid condenses onto the nanoparticles forming droplets of sizes larger than 1 µm.

After the condenser the droplets enter the **optical sensor**. The size of the droplets is analyzed and by counting the droplets the concentration is measured. In contrast to other CPCs the sensor of the UF-CPC uses a patented technology to count particles at concentrations up to $10^7$ P/cm³ without diluting the aerosol.

Figure 3 shows the counting efficiency of the UF-CPC 100 measured by a reputable German laboratory. Higher saturator temperature with unchanged condenser temperature results in a shift of $d_{50}$ to smaller particle sizes therefore increasing the sensitivity of the UF-CPC.

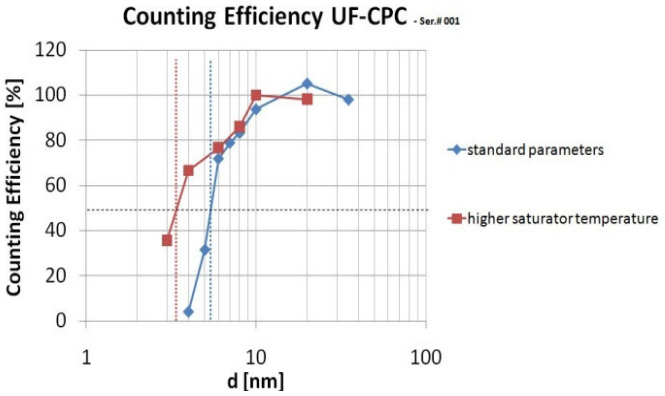


Figure 2: Counting efficiencies of the UF-CPC 100 operated with butanol

**Software**:
Based on continuous customer feedback the user interface and software is designed for intuitive operation and real-time control and display of measurement data & parameters (figure 3).
The software also provides data management with the integrated data logger, sophisticated export capabilities and network support. The measured data can be displayed and evaluated with many options available. If a specific display is desired we can put it in for you!

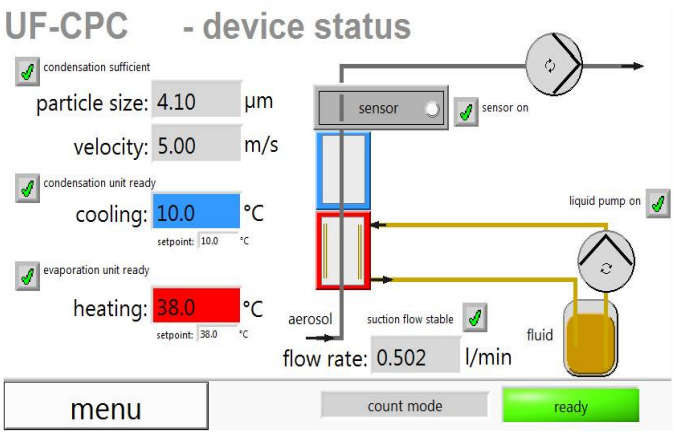


Figure 3: Touch screen user interface showing device status

**References**:
[1] US Patent No.: US 7,543,803 B2