Cambustion

# 5210 CPC

**New!**

Brake & Tyre

Air Quality

Laboratory

Aerosol Fluxes


Bioaerosol

Cleanroom

Healthcare

Cambustion MORE INFO

## Condensation Particle Counter

### Nanoparticle concentration measurement from **5** nanometers **to 10** microns

Cambustion's new 5210 general purpose research grade CPC measures nanoparticles over a wide size range offering possibilities for both established and novel applications.

$d_{50,min}$ 5nm; $d_{50,max}$ >10µm

Fast time response: $T_{10\text{-}90\%}$ ~40ms, $T_{63\%}$ (τ) ~20ms, up to 50Hz data rate

Automatic conversion to any temperature and pressure conditions

Working fluid: Butanol

Touchscreen, Web, Ethernet, RS232, USB, analogue interfaces

Built in pump and active flow control

Wickless mixing design for low maintenance, calibration stability & portability

Cambustion

## CPCs

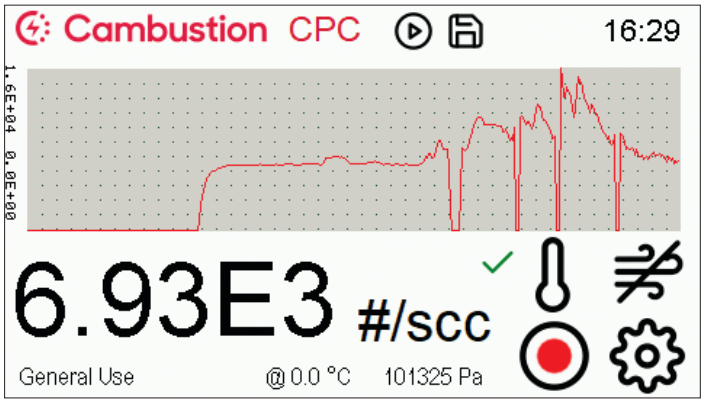
Condensation Particle Counters are adopted for many industry and research applications, where their high sensitivity and accuracy are advantageous. Applications range from ambient, cleanroom & process monitoring through to nanomaterial characterisation.

## Limitations of existing CPCs

Many existing CPCs are unable to measure large particles (for some even above 1 µm) without significant losses in the sampling system and flow path.

## From 5 nanometers to 10 microns

The wide size range of the Cambustion 5210 CPC (launched 2024) supports a host of applications, offering either enhanced suitability compared to traditional CPCs, or even enabling new applications.




## Applications

### Aerosol lab

The 5210 is ideal as a general purpose research grade laboratory CPC. Its wickless mixing approach ensures accurate and stable performance over long periods without maintenance, for reliable and accurate data.

### Vehicle tyres and brakes

Vehicle tyres are a significant source of microplastics in the environment, creating particles up to 10 µm. Friction brakes on vehicles generate aerosol particles of a few nanometers to several microns. The 5210 enables correct measurement and counting of that full size range, particularly larger particles usually under-counted by conventional CPCs.

### Ambient

The 5210 can accurately measure particles below 10 µm, ideal to comply with the PM10 metric.

Low butanol consumption, automatic condensate control and the mixing design ensure low maintenance, stable calibration and long intervals of unattended operation.

### Aerosol flux

The wide size range combined with fast response rate of the 5210 makes this the ideal CPC to measure aerosol flux, coupled with a ultrasonic anemometer.

The choice between touch screen and open communication protocol also make the 5210 CPC easy to use in remote environments.

### Mobile measurements

Use of a saturator with low free liquid volume and a DC power inlet make the 5210 well suited to mobile applications such as emissions or air quality monitoring, without risk of flooding.

### Bioaerosol

Bioaerosols comprising bacteria and viruses typically span the range 50 nm to 10 µm, with fungal spores and pollen grains extending to hundreds of microns.

Particles in the 3–10 µm range are substantially under-counted with existing CPCs, but can be transported significant distances in the atmosphere.

In particular, larger particles carry more mass which may be more significant as pathogen transmission vectors than smaller ones detected by traditional CPCs.

### Cleanroom technology

CPCs are standard in the clean room industry, supporting the creation of spaces suitable for precision manufacturing and biological processes.

Detection of particles over a wider size range up to 10 microns (above which gravitational settling times are very short) supports enhanced clean room monitoring.

### Healthcare

The potential for aerosol particles in the 1–10 µm range to spread pathogens is well documented, and brought into focus by the SARS CoV2 pandemic.

Accurate measurement of such large particles, even down to cleanroom concentrations, affords improved understanding of control measures in healthcare environments.

### Size distribution measurements

Instruments such as the Aerodynamic Aerosol Classifier (AAC, Cambustion) are able to select aerosol particles in a narrow output size range (classification) from a wide input range of 25 nm – >5 µm.

Combining the AAC with the 5210 as part of the Scanning Aerodynamic Size Spectrometer (SASS) allows accurate size distributions to be measured over the AAC's *entire* operating range with a single, high sensitivity detector. The 5210 is plug and play with the AAC to form a SASS system.

### Mass distribution measurements

Cambustion's Mass & Mobility Aerosol Spectrometer ($M^2AS$) allows characterisation of materials according to mass distribution over a large size range (currently 50 nm to > 3 µm). The enhanced sensitivity of the 5210 to larger particles makes it an ideal component of the established $M^2AS$ for materials characterisation.

## Unique combination of technology

The 5210 relies on measurement techniques which have continuously evolved over the last century since Aitken's original devices.

### Straight through sample path

A straight through sample path with no turns or bends ensures that large particles are able to reach the detector without losses through impaction. Most existing commercial CPCs do not feature a straight through flow path, and this inevitably leads to losses of larger particles.

### Fast time response

Careful attention to flow design ensures the 5210 has a fast time response, offering a $T_{10\text{-}90\%}$ response time of ~40 ms, $T_{63\%}$ (τ) ~20 ms (coupled with a data rate of up to 50 Hz).

Averaging may always be applied in software, but the fast inherent time response makes the 5210 ideal for studying sub-second phenomena, including revealing the stability of an aerosol source or time-varying features such as those caused by atmospheric dispersion.

Even in laboratory experiments, it is unwise to assume that a process is stable without considering the *response time* (not just the *data rate*) of the instrument used, as many processes may exhibit sub-second variability.

### Automatic conversion to reference conditions

Concentrations of particles expressed as N/cc are dependent on the properties of the gas, specifically temperature and pressure. As temperature and pressure change, a specific sample of gas will expand or contract while containing the same number of particles.

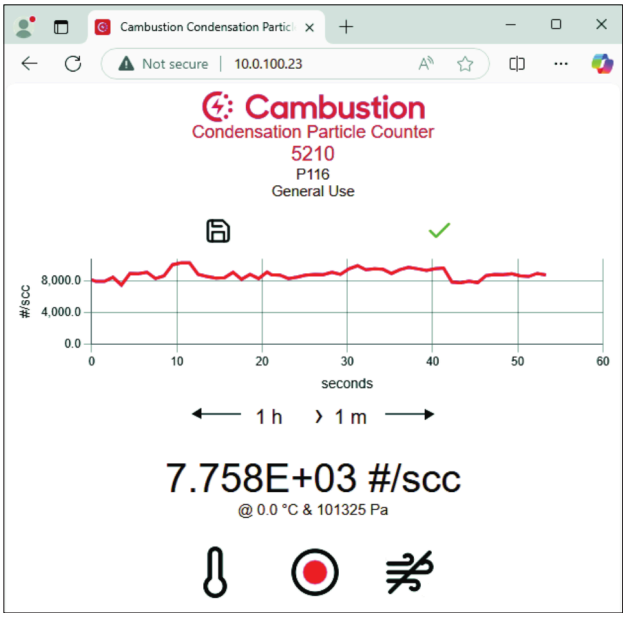
It is therefore important to always state which temperature and pressure the measurement was taken at. With many CPCs this is often not specified or is unclear.

The 5210 CPC measures and reports the measurement conditions and provides automatic conversion to any reference conditions of temperature and pressure at the touch of a button. The user can also select from a variety of aerosol carrier gases including air, $N_2$, $CO_2$ or argon and the flows will adjust to give the correct concentration.

### Easy to use, powerful features

The 5210 is controlled from the built-in touch screen or via a web based interface. The touch screen even operates when briefly exposed to temperatures as low as −25 °C.

All main controls are easily accessible — with no need to enter sub-menus to start the measurement.




The 5210 supports control over Ethernet, USB or RS232, with open protocol commands to automate your own experiments. All protocols are documented in the manual.

Audible and visual alerts for butanol refill and sample flow are provided, together with "value added" data including average pulse height and width measurement.

### Stable calibration and low maintenance

In CPCs which pass aerosol through the saturator (especially ones using a wick) contamination leads to gradually deteriorating performance and drifting calibration. The 5210 uses a mixing design in which the sample does *not* pass through the saturator. The 5210 has no wick, reducing the requirement for consumables.

This ensures long term measurement accuracy and low maintenance. Condensate which has become contaminated with sample is automatically removed into a waste bottle to maintain performance.

### Easy handling and transport

CPCs are often used for field experiments, and ease of shipping / handling is essential.

In CPCs with wicks and large saturator reservoirs, effective draining of the reservoir may be challenging, leading to the risk of flooding the optics during handling / shipping.

The 5210 uses a small volume saturator, and can automatically remove the small quantity of working fluid in the saturator upon shutdown, rendering the CPC immediately ready for safe transport.

### Integrated pump & reliable flow rate control

The use of an integrated sample pump ensures one-box simplicity of operation. Sample flow is actively measured and controlled for optimum stability and accuracy. The integrated sample pump may be configured to start automatically after warm-up if desired.

Additional internal pumps enable water removal, for sustained sampling of high humidity aerosol.

### Butanol working fluid

A wealth of performance data exists for butanol as a working fluid for CPCs. Cambustion has initially selected butanol, and selected a design approach with very low working fluid consumption.

### Flexible power supply

Supplied with a 100–240 VAC adaptor, operation is also possible from an external 24 VDC supply (12 VDC option).

This supports easy operation from batteries, and also provides a low voltage configuration for hazardous environments. Innovative thermal management reduces power consumption.

### Variable size cut selection

The 5210 supports different configuration files to allow variable size cuts.

## Specifications

| | |
|---|---|
| Minimum detectable size ($d_{50,min}$) | 5 nm |
| Maximum detectable size ($d_{50,max}$) | > 10 µm |
| Maximum concentration | 100,000 (1E5) N/cc |
| Response time $T_{10\text{-}90\%}$<br>$T_{63\%}$ (τ) | ~ 40 ms<br>~ 20ms |
| Data rate | up to 50 Hz |
| Data Averaging | 20 ms – 60 s |
| Typical butanol consumption | 1 ml / hr |
| Condensate removal | Automatic |
| Power supply | 100 – 240 VAC 50/60 Hz or<br>24 VDC (12 VDC option) |
| Power consumption | 120 W startup<br>50 W typical operation |
| Sample flow | 0.3 lpm |
| Inlet pressure | 100 mb below ambient |
| Aerosol carrier gas selection | Air, $N_2$, $CO_2$, Ar |
| Vacuum pump | Internal, automatic |
| Data recording | USB drive, up 50 Hz |
| Weight | 6 kg |
| User Interface | 4.3 inch touchscreen<br>& web interface |
| Warm-up time | < 10 mins after power on |
| Dimensions | 28 x 33 x 17 cm |
| Environmental conditions (operating) | 5–35 °C<br>0–95% RH non condensing |
| Digital Communications | RS232, USB C, Ethernet.<br>Open command protocol<br>Plug and play with Cambustion AAC, CPMA & $M^2AS$ over all interfaces. |
| Analogue output | 0 – 10 V |
| Preliminary specifications subject to review and change without notice | |

CLASS 1 LASER PRODUCT

Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019

Cambustion is an independent, privately owned company with headquarters in Cambridge, UK.

We continue to research & develop novel instrumentation, and also offer measurement consultancy; helping our global clients to solve a wide range of particle and gas measurement challenges.

Cambustion

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