Handheld diffusion size classifier for nanoparticle measurement.

testo DiSCmini
Nanoparticle measurement anywhere. It already exists.

testo DiSCmini operates without working fluids or radioactive sources and works in any orientation.

The Diffusion Size Classifier miniature DiSCmini is a handheld sensor for the measurement of nanoparticle number, average diameter and lung-deposited surface area LDSA with a time resolution of up to 1 second (1 Hz). The measuring principle is based on electrical charging of the aerosols. The small size of the DiSCmini makes the instrument particularly suitable for personal carry-on measurement campaigns. The instrument is battery powered with a lifetime of up to 8 hours; data can be recorded on a memory card, and transferred to an external computer via USB cable.

DiSCmini is particularly efficient for personal exposure monitoring in particle-loaded work space with toxic air contaminants such as diesel soot, welding fumes, or industrial nanomaterial. DiSCmini detects particles ranging in size from 10 to about 700 nm, while the modal value should lie below 300 nm. The concentration range is from about 1'000 to over 1'000'000 particles per cubic centimeter. The accuracy of the measurement depends on the shape of the particle size distribution and number concentration, and is usually around 15-20% compared to a reference CPC.
testo DiSCmini is the smallest instrument capable of nanoparticle number measurement available today, with a patented sensor, working in any orientation.

The handheld “Diffusion Size Classifier” can be used for personal exposure monitoring or quick walk-through surveys of an area of interest, such as a workplace, or an urban area with heavy traffic.

Raw data files can be imported directly into Excel, or analyzed with a cross-platform software tool.

Technical Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean particle size</td>
<td>10 to 300 nm (modal diameter)</td>
</tr>
<tr>
<td>Particles counted</td>
<td>10 to 700 nm</td>
</tr>
<tr>
<td>Particle concentration</td>
<td>Detectable particle concentrations depend on particle size and averaging time. Typical values are given below. 20nm: 2E3 to 1E6 pt/ccm 100nm: 5E2 to 5E5 pt/ccm</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±30% in size and number typical; ±5E2/ccm absolute in number</td>
</tr>
<tr>
<td>Flow rate</td>
<td>1,0 L/min ±0,1 L/min</td>
</tr>
<tr>
<td>Operating conditions:</td>
<td></td>
</tr>
<tr>
<td>Pressure</td>
<td>800 to 1100 mbar abs ambient; Δp max. at inlet: ±20 mbar</td>
</tr>
<tr>
<td>Temperature</td>
<td>+10 to +30 °C; relative humidity &lt;90 %RH</td>
</tr>
<tr>
<td>Time resolution</td>
<td>1 second</td>
</tr>
<tr>
<td>Dimensions</td>
<td>120 x 80 x 40 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>0.7 kg</td>
</tr>
<tr>
<td>Power requirements</td>
<td>The battery charger is compatible with the any 100-120 volt or 200-240 volt 50/60 Hz AC wall outlet</td>
</tr>
<tr>
<td>Battery lifetime</td>
<td>8 hours typical; varies with ambient temperature. Charging time 2-4 hours depending on charger and status of battery.</td>
</tr>
</tbody>
</table>
Compared to a CPC, testo DiSCmini is truly handheld, easier to use and it delivers not only the particle number concentration but also average particle diameter and lung-deposited surface area. testo DiSCmini measures size particles smaller than about half a micron in diameter.

Due to its small size and low weight, the testo DiSCmini can also be used easily for airborne measurements.

The internal charger can be turned off, and the DiSCmini will then operate as the world’s smallest aerosol electrometer.

**Ordering information**

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>133</td>
<td>testo DiSCmini - Handheld Nanoparticle Counter</td>
</tr>
<tr>
<td>78050</td>
<td>Power cord 2 m, 2 x 0.75 mm² Euro-plug</td>
</tr>
<tr>
<td>78051</td>
<td>Power cord 1.8 m, 2 x 18 AWG US/JP-plug</td>
</tr>
<tr>
<td>78052</td>
<td>Power cord 2 m, 2 x 0.75 mm² GB-plug</td>
</tr>
<tr>
<td>78053</td>
<td>Power cord 2 m, 2 x 0.75 mm² AU-plug</td>
</tr>
<tr>
<td>2026</td>
<td>Yearly Service Pack (including calibration) for DiSCmini</td>
</tr>
<tr>
<td>2036</td>
<td>Calibration DiSCmini</td>
</tr>
</tbody>
</table>

Please select the country specific power cord:

- **78050** Power cord 2 m, 2 x 0.75 mm² Euro-plug
- **78051** Power cord 1.8 m, 2 x 18 AWG US/JP-plug
- **78052** Power cord 2 m, 2 x 0.75 mm² GB-plug
- **78053** Power cord 2 m, 2 x 0.75 mm² AU-plug

**Accessories and spare parts DiSCmini**

- **91066** SD-Card
- **91078** SD-Card reader
- **6051** Battery charger Mascot (enables also long-term measurements)
- **91068** Carrying bag
- **91069** Aluminium transport case
- **91070** Impactor adapter
- **91071** Barbed fitting
- **91072** Special tube for nanoparticle sampling

**Spare 2-pin power cord**

- **78050** Power cord 2 m, 2 x 0.75 mm² Euro-plug
- **78051** Power cord 1.8 m, 2 x 18 AWG US/JP-plug
- **78052** Power cord 2 m, 2 x 0.75 mm² GB-plug
- **78053** Power cord 2 m, 2 x 0.75 mm² AU-plug
Professional Committees:
Committee for Environmental Sciences and Teaching.
Representative of the Faculty of Medicine at the University of Berne.
President of the committee for pre-clinical affairs.
Institute for Environmental Medicine Lucerne, Scientific counsellor.
President of Foundation Gen Suisse.

Member of following Professional Organizations:
International Society for Aerosols in Medicine (ISAM)
American Thoracic Society (ATS)
European Respiratory Society (ERS)
Swiss Society for Optics and Microscopy (SSOM)
International Society for Stereology (ISS)
Clinical Research Foundation for the Promotion of Oral Health (SKF)
Reason for measuring?

Where do nanoparticles occur?
Everywhere. You breathe in millions of different particles with every breath. The majority of these are nanoparticles.

Why are these harmful to the human body?
When talking about nanoparticles, we need to differentiate between two groups. On the one hand, we have those resulting from combustion processes. They are exhaust fumes created by traffic and by heating systems. They form the largest part. And then we have the artificial nanoparticles such as titanium dioxide, metals, metal oxides and carbon nanotubes, just to name a few, which are created artificially.

And why do they harm us?
The larger particles behave differently to the nanoparticles in a biological environment, i.e. in human beings. Because they are so small, the nanoparticles which we breathe in enter the deepest part of our lungs, the so-called alveoli. Nanoparticles possess the property of being able to penetrate easily into cells and to pass through them and through tissue. Therefore, in the alveoli they can penetrate into the blood vessels, and with this being distributed in the whole organism. Larger particles can’t do this. And that, in my view, is what makes them so critical, as compared to larger particles.

What are the medical consequences of this?
The harmful consequence which we know of, is that the cell can be destroyed. Or that the nanoparticles can penetrate the cell nucleus and may lead to damage to the genetic material. It can also cause the cell to enter a situation of uncontrolled division, which ay lead to cancer. We are speaking here – and this is one of the most critical things – of so-called „gene toxicity“. This means that nanoparticles may lead to genetic damage. This, however, needs a lot of research still.

Why is it so important to carry out nanoparticle measurements close to human beings?
As the name suggests, the nanoparticles are so small that they hardly sink. Unless they agglomerate. When that happens, they immediately sink and settle, and are no longer measurable in the air. On the other hand, nanoparticles are much more inert than gas molecules, so they tend to stay close to their source. The concentration of nanoparticles caused by traffic, for example, decreases drastically within just a few metres, because they move away from the road quite slowly. If we want to find out which effect this has on humans, we need to look at which nanoparticles exist in a person’s direct vicinity, and in which concentrations and size. If we measure further away, many nanoparticles are no longer present.

There are two measurement methods: Nanoparticle counting and mass measurement. Usually, mass measurement is used.

Why is a mass measurement with PM10 for nanoparticles not meaningful, and why is nanoparticle counting so relevant?
The supporters of PM10 measurement take the view that measurements are very easy to carry out, as there are measurement stations everywhere. However: If you use mass measurement, you simply don’t record the nanoparticles. A measurement using PM10 tells you absolutely nothing at all about nanoparticles. Nanoparticles, however, may be more of a problem for the body than larger particles, as, inhaled, they can enter cells, tissues and the blood vessels rather easily. And it is there, close to the body, where measurements need to be conducted. You only record this exposure if you measure the number of nanoparticles, which are the actual problem component of the particles in the air pollution. And the reason they are problematic is because they can easily enter deeper regions in the organism.

So could we say, in layman’s terms, that PM10 or PM 2.5 are still important measurement methods, but that nanoparticle counting is just as important as a complement to them?
Yes, nanoparticle counting is an important complement. And in my opinion, it will probably in time replace PM10. Let me explain: Among the large particles which are recorded using PM10, there are many which are actually no problem for us. Not from a health point of view, not toxic, not because of their size. And, if I can generalize for a moment, it is the very small carbon particles in particular, the so-called carbon blacks, which are the critical ones. Basically, we can say that we can evaluate the air quality by counting the carbon blacks, and that this evaluation can only ever be very rudimentary using PM10. Example: In many cities, the speed limit on the highways is reduced to 80 km/h when there is inversion weather. But this has resulted in only a very slight reduction in the measurement of PM10. I believe that if the number of carbon blacks had been measured, i.e. not simply all nanoparticles in the PM10 fraction, but the carbon black fraction instead, then quite considerably larger differences would have been determined. This is the only way we can take meaningful measurements and make decisions based on them. The particle number is therefore definitely the better parameter. These critical nanoparticles cannot be determined using their mass. And today we can say that nanoparticles are more dangerous than larger particles. Previously, the opposite was thought. Today we have moved on. We now know more.

How do you explain the fact that automobile exhaust legislation regulates nanoparticle emissions, but there are no standards for ambient air?
I think maybe it is not so well-known that the number of nanoparticles can be recorded, and that you can also measure their size so easily. At the touch of a button, you have a value which is very reliable, and quickly recorded. And you can go into a room, you can go outside, you can go inside a car. You can practically watch the values increase and decrease. So particle number counting is a great step forward. With it, we have a really good instrument in our hands which we can use to evaluate air quality.
Your partner in nanoparticle management

Our former specialist in nanoparticle management Matter Aerosol has been a member of the Testo family since 2010. In 2015 it has been fully integrated into the Testo AG. With the full integration of the nanoparticle measurement technology business sector, Testo AG is pursuing the objective of a targeted and customer-oriented utilization of the synergies in Research & Development, as well as the extensive and proven possibilities and means available in industrial production, service and sales.

The extensive, specialized and recognized Research & Development know-how of Matter Aerosol is now completed with more than 50 years’ expertise from Testo AG as a world market leader in the field of professional measurement technology. With this new arrangement, accurate solutions in the nanoparticle measurement technology sector will be developed for you.