



Model 1500

## Aerosol Generation and Monitoring System

*High-precision, stable particle generation and classification system for generation of nanometer and sub-micron (10 to 1,000 nm), monodisperse particles for fine particle behavior studies, instrument calibration and fine particle control technologies research:*

- Polydisperse aerosol generator with dryer and electrical ionizer (non-radioactive)
- Differential mobility analyzer
- Condensation particle counter

The MSP Model 1500 Aerosol Generation and Monitoring System consists of three main sections (see flow diagram below): the polydisperse aerosol generator (PAG), the differential mobility analyzer (DMA), and the condensation particle counter (CPC). The DMA and the CPC are separately controlled by a single-board computer, and access is available for the user to take all or part of the aerosol from the outlet of the DMA for any application that requires a highly monodisperse aerosol of known size and concentration.



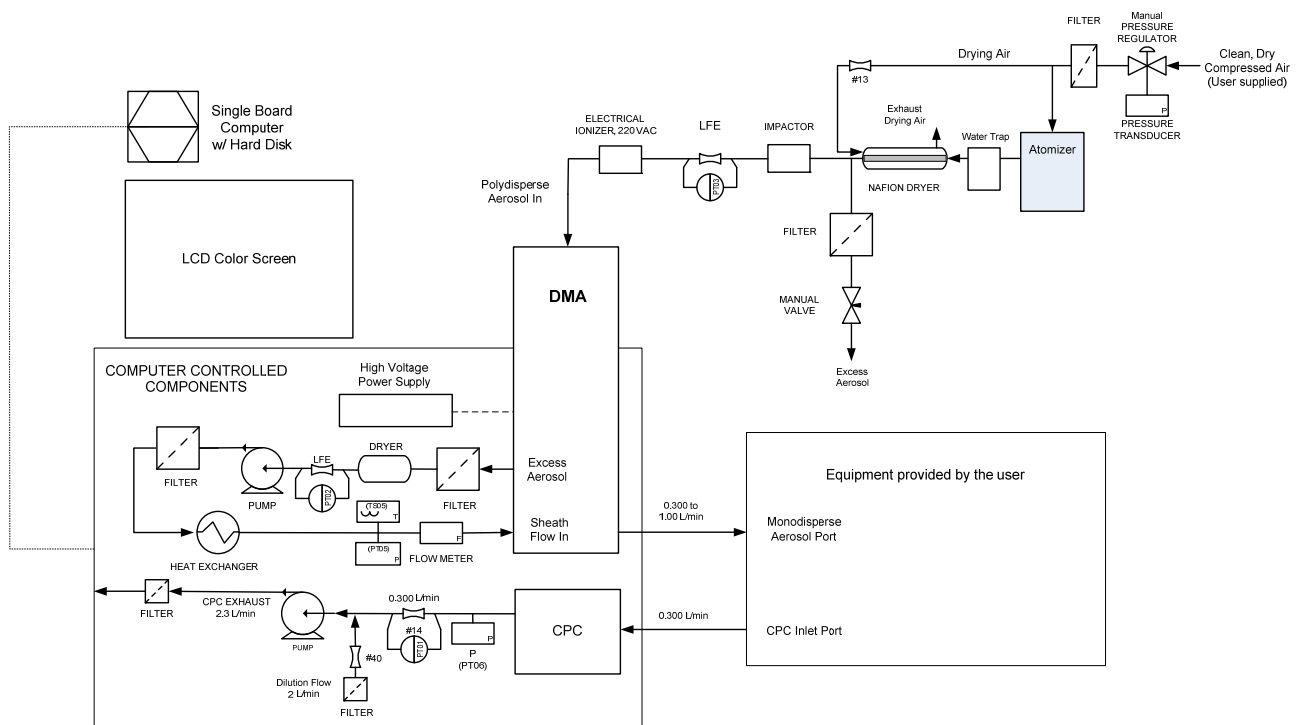
### TECHNICAL DESCRIPTION

The polydisperse aerosol generator has a single jet “Collision-type” atomizer for generating fine droplets of about two microns volume-mean diameter. The user places an aqueous solution or suspension in the atomizer reservoir, and when the droplets exit the atomizer, they are dried in a Nafion<sup>®</sup> Membrane Dryer to evaporate the water and form the final residue particles. A typical solution to put in the atomizer is 1% NaCl for generation of NaCl solid particles. The atomizer is driven by clean, dry, laboratory compressed air connected to the back panel of the Model 1500. Excess polydisperse aerosol, not wanted in the DMA, is exhausted through a filter. The flow rate of the desired aerosol is monitored by the pressure drop across a calibrated laminar flow element. A small impactor removes large super-micron particles or droplets. Finally, the aerosol is neutralized before entering the DMA to best achieve a nearly Boltzmann distribution of charge. This neutralizer uses NO RADIOACTIVE source, accomplishing the neutralization with bipolar ions generated electrically.

The DMA can select particles from 10 nm (when operated at 10-L/min sheath flow rate) to as large as 1000 nm (when operated at 3-L/min sheath flow rate). The DMA works in the flow recirculating mode, where the sheath air flow is in a closed loop with a steady flow that is accurately controlled by a feedback control system. A heat exchanger maintains the closed-loop sheath air temperature at near room air temperature. The absolute pressure and temperature of the sheath air flow are also measured and used by the computer control system to improve the accuracy of the particle electrical mobility and diameter calculations.

The condensation particle counter is of the thermal diffusion type, with a saturator maintained at 35°C and a condenser kept at 10 °C. The CPC has two fluid reservoirs, one for the working fluid (1-butanol) and the other for the condensate fluid. The condensate fluid may contain water when sampling takes place in humid environments. This dual reservoir design leads to a longer life for the working fluid and greater stability.

The Model 1500 Aerosol Generation and Monitoring System is calibrated at the factory to provide NIST-traceable particle sizing by using Polystyrene Latex (PSL) spheres of 269-nm (i.e. SRM 1691) from the National Institute of Standard and Technology (NIST; Gaithersburg, MD, USA).



**Model 1500 Aerosol Generation and Monitoring System  
Flow Diagram**

## SPECIFICATIONS

Instrument Dimensions	17.6" (H) x 24.0" (D) x 20.6" (W) 450 mm (H) x 610 mm (D) x 525 mm (W)
Instrument Weight	88 lbs (40 kg)
Operating Aerosol Pressure	800 to 1050 mbar absolute pressure
Ambient Temperature Range	10 to 35 °C
Ambient Humidity Range	0-90% RH, non-condensing
Power requirements	110 or 220 VAC, 50-60 Hz, single phase, 250 W max, 160 W avg

### Polydisperse Aerosol Generation System

Single-Jet Atomizer	Stainless Steel Construction
Pressure	15 to 60 psig (100 to 415 kPa gauge), controlled by pressure regulator
Aerosol Flow Rate	Typical 3 L/min @ 35 psig (240 kPa gauge)
Volume-Mean Droplet Diameter	about 2 µm (GSD < 2.0)
Aerosol Size Range	10 to 2000 nm
Aerosol Concentration	> 10 <sup>7</sup> particles/cm <sup>3</sup> (typical for NaCl)
Dryer	Diffusion type (Nafion <sup>®</sup> membrane requires source of clean, dry air)

### Differential Mobility Analyzer

Inlet Aerosol Flow Rate	0.3 to 1.0 L/min, controlled externally by manual valve
Monodisperse Aerosol Flow Rate	0.3 to 1.0 L/min (not directly controlled in aerosol generation mode)
Sheath Air and Excess Air	3.0 to 10 L/min, closed-loop, controlled by internal feedback control system to user-selected setpoint
High Voltage Power Supply	10 to 10,000 V, user-selected (software limits max voltage to 9,000V)
Aerosol Size Range	9 to 1000 nm, user-selected, max size depends on sheath flow rate
Max aerosol input concentration	10 <sup>8</sup> particles/cm <sup>3</sup>
Aerosol Neutralizer	Electrical ionizer (no radioactive source required)
Particle Type	Solids and non-volatile liquids

### Condensation Particle Counter

Working Principle	Laminar continuous flow with single particle detection
Flow Rate	0.300 L/min controlled by internal feedback control system
Particle Diameter Range	5 nm to 2 µm
Count Accuracy	± 10% (compared to std MSP CPC); Single particle counting mode
Concentration Range	0 to 10 <sup>4</sup> particles/cm <sup>3</sup> ; (single particle counting mode)
Working Fluid	1-butanol (n-butyl alcohol)
Response Time (95% response)	< 10 sec

*Subject to Change without Notice*



**Innovative Products  
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**MSP Corporation**  
5910 Rice Creek Parkway  
Suite 300  
Shoreview, MN 55126

Tel 651-287-8100  
Fax 651-287-8140  
[sales@mspcorp.com](mailto:sales@mspcorp.com)  
[www.mspcorp.com](http://www.mspcorp.com)

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