

# Fast scanning mobility particle sizing system and classifier

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Keywords: SMPS, DMA, 15900, CPC

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Since the scanning concept was introduced by Wang and Flagan in 1990, differential mobility classification has become the measurement principle of choice for making aerosol size distribution measurements in the 1 nm to 1  $\mu\text{m}$  size range. Devices such as the TSI Model 3080 Classifier, typically used as part of a Scanning Mobility Particle Sizer (SMPS) system, operate by this principle. While the technique has a reputation for reliability because it is based on basic physical principles, its primary drawback is response time: it typically takes 60 seconds or more to complete a scan.

In order to meet the need for faster measurements while leveraging the reliability of differential mobility classification, a new classifier (TSI Model 3082) is presented to enable scanning at rates down to 5-seconds (see Figure 1).

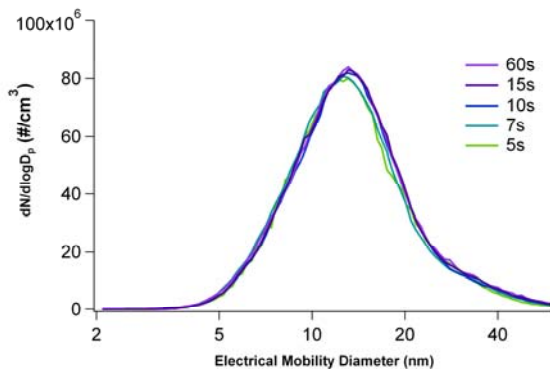


Figure 1. Polydisperse silver aerosol size distribution obtained at various scan times between 5s and 60s.

The 3082 retains the functions of the 3080 with the following additions:

1. Dual polarity DMA high voltage control with <50 ms response time for faster scanning
2. 50 Hz data sampling for higher time resolution
3. 30 L/min sheath flow capability for higher size resolution and wider size range
4. Integrated and removable x-ray bi-polar charge neutralizer (Scheckman *et al*)
5. Integrated and removable inlet impactors for aerosol flow measurement and particle pre-separation
6. Tool-free installation of DMAs and impactor set

Precise control of high voltage and sheath flow coupled with well-characterized CPC response time allows for  $\pm 1\%$  size accuracy at 100 nm. Calibration of the device complies with ISO 15900 Standard, which was put in place to provide methodology for adequate quality control of differential mobility devices.

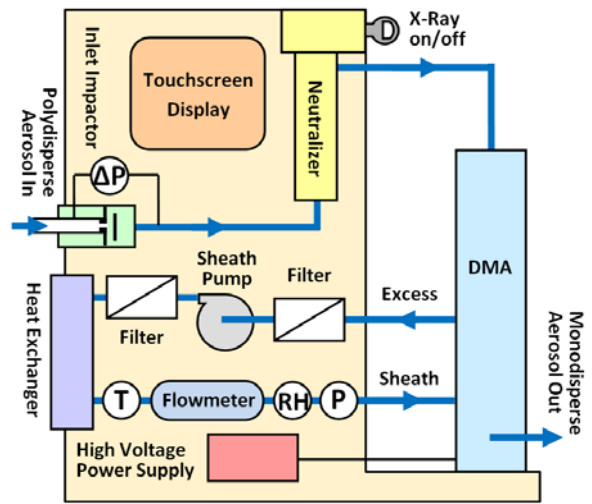


Figure 2. Flow schematic for the TSI Model 3082 Classifier.

Equivalence data comparing SMPS scans using the TSI Model 3082 Classifier versus the TSI Model 3080 Classifier are presented. These data demonstrate the agreement of both classifiers at traditional scanning rates as well as the advantages of the new model at reduced scan times.

Wang, S.C. and Flagan, R.C. (1990) *J. Aerosol Sci.* 13:230-240.

Scheckman J.H., Elzey S., Farnsworth J.E., Horn H.-G., and Osmondson B. (2013) *Proc. of Euro. Aerosol Conf.* In Preparation.

ISO 15900:2009(E) Determination of particle size distribution – Differential electrical mobility analysis for aerosol particles.