ACTRIS Recommendation for Ecotech Integrating Nephelometers 3000 or 4000 measurements: Part I recommended instrument set-up

Marie Laborde (Ecotech) and Alfred Wiedensohler (Leibniz Institute for Tropospheric Research)

ACTRIS Technical Standard

Technical Features of the Nephelometers

All the nephelometers from Ecotech are by default equipped with an internal blower. This blower may not be sufficient to create a sample flow in the following cases:

- common inlet with other instrument
- long inlet line or restricted line

In order to avoid sampling problems, the installation of a separate external vacuum pump is recommended. In addition to the external pump, an unrestricted ball valve and its controller is also recommended in order to avoid disturbance to the instruments sampling from the same inlet during the nephelometer calibration.

The ball valve should use the information taken from the nephelometer (service port) to switch the ball valve position during calibration from normally open position (N_0) to the normally closed one (N_C). In the No position ambient sample is drawn from outside the lab to the exhaust pump through the nephelometer. This configuration is suitable for normal operation only. In the N_C position, the ball valve switches and the sample in taken from either the zero or the span gas port to the exhaust pump through the nephelometer. This position should only be used during calibration. Fig. 1 is giving an overview of the nephelometer setup.

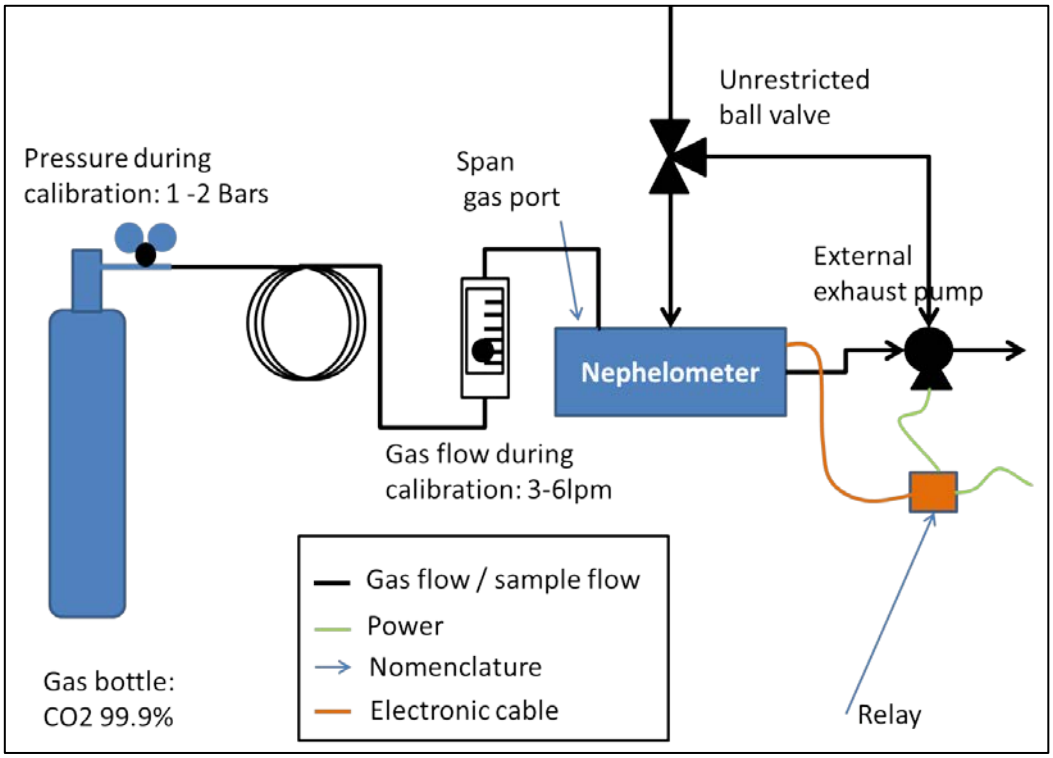

Figure 1: Recommended set-up of a nephelometer for long-term measurements of the ambient aerosol.

Calibration

Relative humidity (RH) Control and Measurement

Due to the hygroscopic growth of atmospheric aerosol particles at RH well below supersaturation, it is essential to control or limit the RH in nephelometers. The philosophy is to obtain comparable data sets and, therefore, to measure the “dry” scattering coefficients. When working in a warm and moist atmospheric environment, the dew point temperature can reach the standard temperature of a measurement laboratory (20-25°C). This requires that the aerosol sample flow has to be dried, either directly in the main sampling line or at the instrument. The recommendation is to limit RH inside an instrument to below 40%. In this regime, changes in particle diameter as a result of RH are expected to be below 5%.

To limit RH in the aerosol sample flow (see also the recommendation for the drying), we concretely recommend using a membrane dryer (made from materials such as Nafion™), or a silica-based aerosol diffusion dryer. Operation of a membrane dryer will require a continuous supply of dry air in the laboratory, while a silica-based dryer will require regular regeneration. Most care should be taken to select or design dryers that feature minimum particle losses, such as due to Brownian diffusion, interception, sedimentation, or impaction.