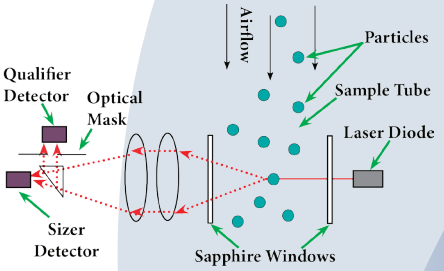
HOW IT WORKS

The FM-120 is a forward-scattering optical spectrometer. For accurate sizing, the FM-120 accepts and sizes only particles that pass through a region of the laser beam with uniform power. This region of the laser is called the depth of field.

As particles pass through the laser beam, light scatters in all directions. The FM-120 collects forward-scattered photons within an annular cone that is approximately 3.5° to 12° from the laser beam. The collected light is then directed onto a 50/50 optical beam splitter and finally to a pair of photodetectors, referred to as the sizer and the qualifier (see figure). There is a mask in front of the qualifier detector to define the depth of field. The edge of the depth of field is defined by the points where half of the light scattered from a particle is blocked by the mask.



The photodetectors then convert the photon pulses into digital pulses. If the qualifier pulse is greater than half the sizer signal, the particle is deemed within the depth of field. The particle is then sized based on the amplitude of the sizer pulse.

SELECTED BIBLIOGRAPHY

J. K. Spiegel, P. Zieger, N. Bukowiecki, E. Hammer, E. Weingartner, and W. Eugster, "Evaluating the capabilities and uncertainties of droplet measurements for the fog droplet spectrometer (FM-100)." *Atmos. Meas. and Tech. Discuss., 5, 3333–3393, 2012. doi:10.5194/amtd-5-3333-2012*

W. Eugster, R. Burkard, F. Holwerda, F. N. Scatena, and L.A.(Sampurno) Bruijnzeel, "Characteristics of fog and fogwater fluxes in a Puerto Rican elfin cloud forest." *Agricultural and Forest Meteorology 139 (2006), 288-306. doi:10.1016/j.agrformet.2006.07.008*

Reto Burkard, Patrick Bützberger, and Werner Eugster, "Vertical fogwater flux measurements above an elevated forest canopy at the Lägeren research site, Switzerland." *Atmospheric Environment 37 (2003), 2979-2990. doi:10.1016/S1352-2310(03)00254-1.*

Otto Klemm, Thomas Wrzesinsky, and Clemens Scheer, "Fog water fluxat a canopy top: Direct measurement versus one-dimensional model." *Atmospheric Environment 39 (2005), 5375 - 5386. doi:10.1016/j.atmosenv.2005.05.041.*

HOW TO ORDER

Contact DMT for pricing or more information: +1.303.440.5576, customer-contact@dropletmeasurement.com.

DROPLET MEASUREMENT TECHNOLOGIES

FM-120

FOG MONITOR

DROPLET MEASUREMENT TECHNOLOGIES

OVERVIEW

The Fog Monitor (FM-120) is an all-weather optical spectrometer that continuously samples droplet-laden ambient air. It measures particles in the 2 - 50 µm range.

The FM-120 is popular on fog monitoring towers, for characterizing droplets in visibility studies, and for evaluation of the super-cooled droplets that lead to highway and power-line icing.

APPLICATIONS

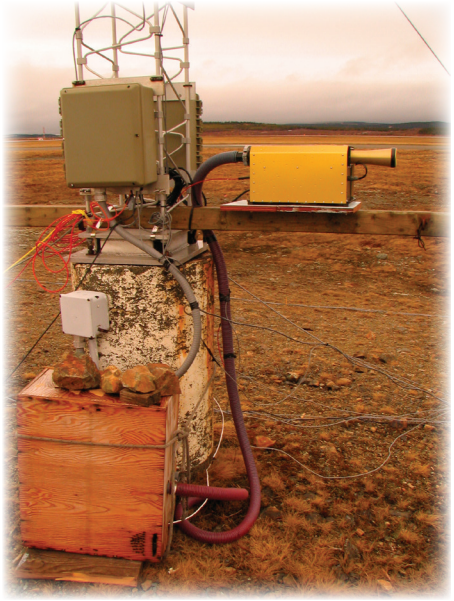
» Weather research
» Studies of fog formation and dissipation
» Visibility and light-extinction studies

The instrument's anti-icing heaters and all-weather enclosure make it suitable for tower mounting.

NEW FEATURES

In September 2012 DMT introduced the FM-120, which improves significantly on the original FM-100. The FM-120 offers the following state-of-the art features:

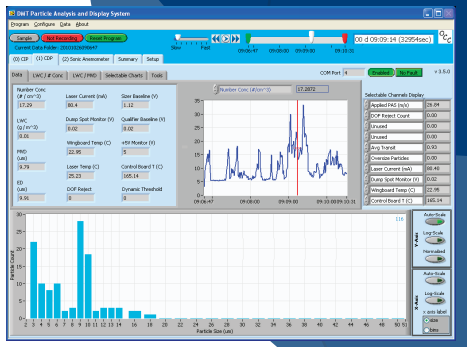
» Nickel-coated optical flow block to prevent static build-up
» More robust electronics, with digitized signals from the photodetectors
» Universal voltage input for analyzer head
» Particle-by-particle data for up to 2048 particles per sampling instance (optional feature—see "Options" section for details)
» Dynamic thresholding feature to account for small drifts in baseline signal
» Raw data available for one particle in each sampling instance, information that serves as an important instrument diagnostic



Above: A Fog Monitor being used by the National Research Council of Canada to study weather near St. John's, the cloudiest and windiest of major Canadian cities.

SOFTWARE

The Particle Analysis and Display System (PADS, shown at right) is included software that provides a user-friendly virtual instrument panel. PADS allows the user to control the FM-120 and display real-time data and logs. For instance, the program enables the user to do the following tasks:



» Sample and record data
» View particle volume and number concentrations, as well as Median Volume Diameter (MVD) and Effective Diameter (ED)
» View LWC as measured by the FM-120
» Monitor laser health and temperatures at various instrument locations
» Play back data for post-flight viewing
» Reprocess data with new parameters for additional analysis

OPTIONS

» *Swivel-head mount* (shown at right): Ensures the FM-120 inlet always faces into the wind
» *Particle-by-particle (PBP) feature*: Provides high-resolution information on particle light-scattering intensity. This in turn allows much more precise and detailed size distributions, as well as minimization of the well-known Mie scattering ambiguities.

The measurement of particle interarrival times provides both an independent measure of particle concentration and the capability of evaluating the fine-scale structure of fog. Evaluation of the interarrival times allows the study of inhomogeneities in the fog structure and analysis of entrainment and mixing. These important processes control the evolution of fog properties and affect visibility and regional climate change.

The PBP particle times are accurate to within a microsecond, an improvement by a factor of a million over the standard FM-120 data.

INCLUDED ITEMS

» Spectrometer
» Laptop computer
» PADS software
» Sample pump
» Test cables
» Calibration fixture
» 30 micron glass beads
» Glass beads dispenser
» Custom shipping case
» One day of training at DMT facility
» One-year warranty
» Email and phone technical support

FM-120 SPECIFICATIONS

Measurement Technique	Single-particle forward light scattering
Data Parameters	» Particle diameter » Particle number concentration » Liquid water content (LWC) » Effective diameter (ED) » Median volume diameter (MVD) » Temperature » Pressure
Particle Size Range	Droplets with 2-50 µm diameter
Number of Size Bins	30
Typical Sample Area	0.24 mm^2
Sample Flow Volume	1 m^3/min
Sampling Frequency	» Standard Data Rate: Selectable, 0.04 sec to 20 sec » PBP Data Rate (for optional PBP feature): No limit until particles are coincident
Refractive Index	Non-absorbing, 1.33 (the industry standard for water)
Light Collection Angles	~3.5º - 12º
Data System Interface	RS-232 or RS-422 serial interface Up to 460 kB
Calibration Verification	Precision glass beads
Software	Particle Analysis and Display System (PADS) software, included
Environmental Operating Conditions	» Temperature: 0 to 40 °C » Relative Humidity: 0 - 100%, non-condensing » Altitude: 0 - 4,000 meters
Weight	10.0 kg (instrument), 9.5 kg (pump)
Probe Dimensions	23 cm H x 28 cm W x 37 cm L
Power Requirements	» Universal input for analyzer head, 50-60 Hz » 115-120V or 230V for pump (set at factory, but user-configurable) » 200W (instrument), 400W (pump)

Specifications are subject to change without notice. The FM-120 is a Class I Laser Product.

Rev B

November 1, 2012

DROPLET MEASUREMENT TECHNOLOGIES

2545 Central Avenue
Boulder, Colorado, USA 80301
www.dropletmeasurement.com
ph: 303-440-5576, fax: 303-440-1965