



*Provides continuous size distribution and number concentration data for long-term, air quality monitoring!*

### Features and Benefits

- Long-term, unattended operation
- Low start-up and operating costs
- No working fluids; no radioactive source
- Convenient data management with remote access via the Internet
- Continuous measurements every 11 minutes
- Optional environmental sampling system

### Ultrafine Particle (UFP) Monitor Model 3031

The Model 3031 Ultrafine Particle (UFP) Monitor has been specifically designed for long-term, air quality monitoring networks. It operates continuously, 24-hours a day, for months on end, with minimal maintenance and requires no working fluids. The UFP Monitor has no radioactive source, so there are no special licensing requirements and no restrictions for its use or where it can be installed. The Model 3031 fits into a standard 19-inch, rack mount cabinet, which allows it to be easily installed into existing roadside and urban air quality monitoring stations. A bench top version of this instrument (the Model 3031-1) is available for laboratory or mobile applications

### Applications

Long-term, unattended environmental monitoring for

- Road side measurements
- Urban air pollution research
- Epidemiology studies
- Traffic monitoring





## The Problem: Ultrafine Particles are an Emerging Health Concern

While PM<sub>10</sub> levels of airborne particles in many urban areas have dropped significantly over the last decade, the incidence of acute respiratory problems and disease attributed to air pollution continues to rise. Many environmental, epidemiological and health-focused organizations, including government agencies, now recognize that ultrafine particles contribute to adverse health effects. To better understand the health effects, we must complement traditional measurements (PM<sub>10</sub> and PM<sub>2.5</sub>) by establishing networks to routinely monitor ultrafine particles.

## The Solution: Long-Term Ultrafine Particle Monitoring

The UFP Monitor measures the size distribution and number concentration of particles between 20 and 1000<sup>1</sup> nm, with six channels of size resolution. It continuously provides the number concentration for each size channel every 11 minutes. All data is buffered within the instrument, but can be accessed remotely via the Internet or archived periodically as part of the normal routine of the monitoring station.

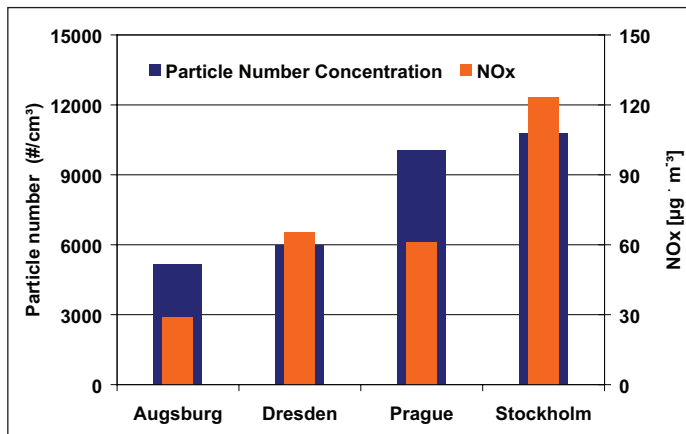
Developed under the auspices of European Union's UFIPOLNET project, the UFP Monitor has demonstrated it is well suited for long-term, ultrafine particle monitoring. Since the beginning of 2007, four UFP Monitors have been routinely monitoring ultrafine particles in Stockholm, Dresden, Prague and Augsburg. These instruments continue to provide valuable data about the temporal levels of ultrafine particles and their sources.

<sup>1</sup>The actual upper limit is set by the sampling inlet.

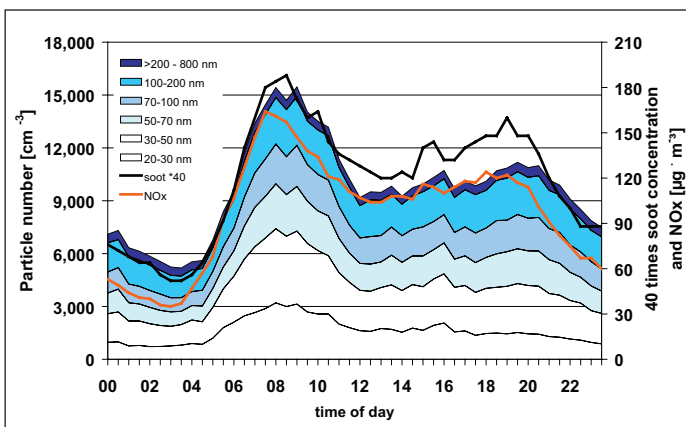


**UFIPOLNET**

ultrafine particle size distributions  
in air pollution monitoring networks



Mean particle number concentrations from UFP Monitor and NOx calculated from hourly data at 4 measuring stations, June 2007.



Half-hour average particle number concentrations from UFP Monitor compared to NOx, soot; weekly average 24/1-19/3/07

Reference: Saxon State Agency for Environment and Geology (LfUG), Data from measurements in EU-LIFE project UFIPOLNET, which was cofunded by the European Community under LIFE04 ENV/D/000054  
Source: Holger Gerwig, LfUG

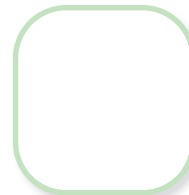
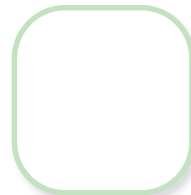
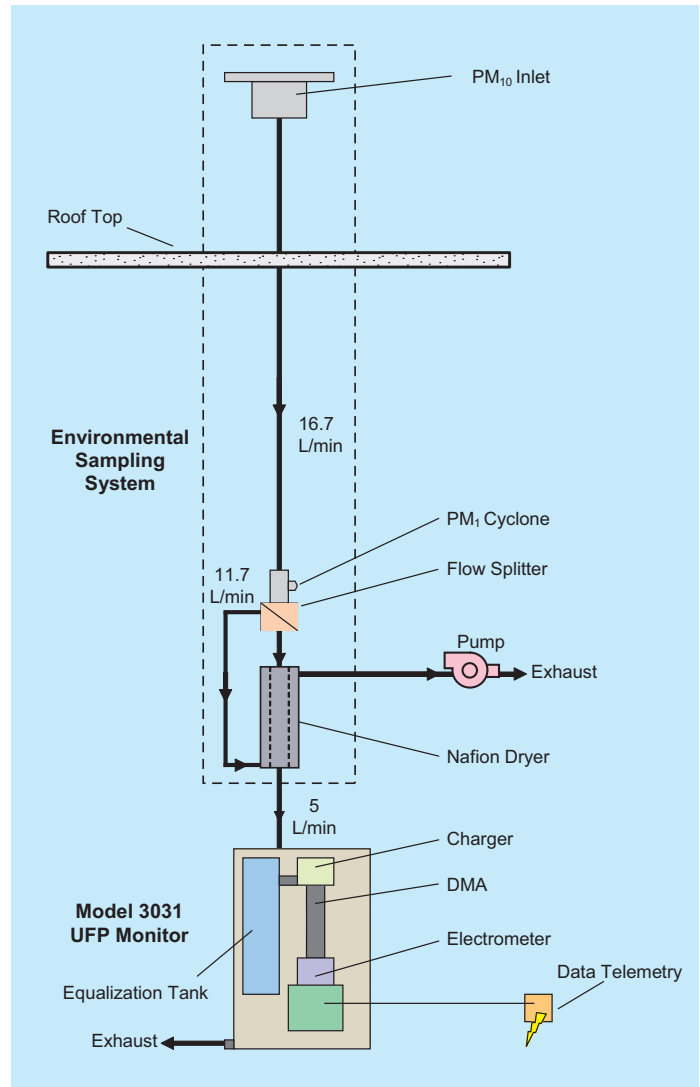
## Operation

Using TSI's environmental sampling system (sold separately), a representative sample of ambient air is continuously drawn through a size selective  $PM_{10}$  inlet at a standard flow rate of 16.7 L/min. Next, the sample passes through a  $PM_{10}$  cyclone which removes larger particles. The main sample stream is subsampled into the UFP Monitor at a flow rate of 5 L/min. A Nafion® dryer upstream of the UFP Monitor ensures proper conditioning of the aerosol to minimize effects due to relative humidity. The remaining 11.7 L/min. of make-up air is routed through the Nafion® dryer as purge air and drawn through a vacuum pump and exhausted.

Within the instrument, the aerosol sample mixes in an equalization tank and then passes through a diffusion charger, which charges all particles positive. The charged particles are then size separated using a Differential Mobility Analyzer (DMA), collected by a filter and the imparted current is measured using a sensitive aerosol electrometer. By successively stepping the DMA voltage and measuring the current at each step, an on-board computer calculates and stores the number concentration for each of the six size channels. One measurement cycle takes 10 minutes (approx.) with an additional one minute zeroing time between cycles. Data and system status can be viewed using a standard web interface or automatically downloaded to a spreadsheet or database. Instrument set-up parameters can also be adjusted remotely via the web interface.



Sampling site in Dresden, Germany



## Specifications

## Model 3031

**Measuring Principle**  
Electrical Mobility

**Particle Size Range**  
20 to ~ 1000<sup>1</sup> nm nominally

**Particle Size Resolution**  
6 Channels  
20–30 nm, 30–50 nm, 50–70 nm, 70–100 nm, 100–200 nm, and >200 nm

**Concentration Range**  
500 to 10<sup>6</sup> particles/cm<sup>3</sup> at 20 nm;  
50 to 10<sup>6</sup> particles/cm<sup>3</sup> at 200 nm

**Time Resolution**  
10 min (1 min zero time additional)

**Environmental Operating Conditions**  
**Ambient Temperature** 10 to 40°C (50 to 104°F)  
**Ambient Humidity** 0 to 90% RH (non-condensing)  
**Ambient Pressure** 90 to 110 kPa (0.89 to 1.09 atm)

**Aerosol Humidity<sup>2</sup>**  
< 50% RH

**Inlet Flow Rate**  
5 L/min

**Front Panel Display**  
8.4-in. SVGA (800 × 600 pixel) color display with touch screen interface

**Interfaces**  
Ethernet  
RS-232  
USB

**Power Requirements**  
100 to 240 VAC, 50-60 Hz

**Dimensions**  
**Model 3031** 19-in. frame rack 16HU (71 cm) Depth 41 cm  
(HWD) 71 × 48.3 × 41 cm (28 × 19 × 16 in.)  
**Model 3031-1** Bench top cabinet  
(HWD) 74 × 42.8 × 42.8 cm (30 × 17 × 17 in.)

**Weight**  
40 kg (88 lbs)

**Aerosol Inlet**  
¼-inch OD

**Cyclone Inlet**  
¼-inch OD

<sup>1</sup> The actual upper limit is set by the sampling inlet

<sup>2</sup> Sample conditioning recommended for high humidity conditions to maintain aerosol RH below 50%. Refer to model 3031200 Environmental Sampling System.



## To Order

## Ultrafine Particle Monitor

Specify	Description
3031	Ultrafine Particle Monitor (19-inch, rack mounted cabinet)
3031-1	Ultrafine Particle Monitor (bench top cabinet)

## Accessories

Specify	Description
3031200	Environmental Sampling System (includes a standard PM <sub>10</sub> inlet, a PM <sub>1</sub> cyclone, a Flow Splitter and a Nafion dryer)
1031588	Consumables Kit UFP Monitor 3031, 3031-1 (includes four HEPA capsule filters, eight Balston DFU-BX filters, four carbon cartridge filters, one wire core microfiber filter and three ft tygon tubing)

Accessories must be ordered separately

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