Environmental Monitoring Systems

Air pollution measurement unit (online) for determining the concentration of PM_{10} and $PM_{2.5}$

Type: APM-2 Air Pollution Monitor

This new measuring instrument, designed to determine the concentration of suspended dust particles, makes use of the light reflected by tiny particulate matter (nephelometer).

Our Air Pollution Monitor APM-2 which uses a photometric light scattering measurement technique, has passed the type-approval test of the TÜV Rheinland in accordance with the new guideline for the fractions PM_{10} and $PM_{2.5}$ (EN 12341:2014). The measurement method used in the APM-2 has been confirmed as being equivalent to the previously used gravimetric method according to the guideline: ***"Demonstration of Equivalence of Ambient Air Monitoring Methods"***. The previously identified correction factors/ terms have been taken into account.

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- Online measurement unit
- Determines, alternately, the concentrations of PM_{10} and $PM_{2.5}$ particulates
- Simple operation,
- Quick selection with jog dial
- Large, backlit display
- Display of all measurement parameters
- Data transmission via GPRS modem (optional)
- Simple software updating using flash RAM
- Only an annual verification against the reference method is necessary

APM-2 in a stainless steel housing

The APM-2 is a measurement instrument used for direct and continuous determination of the concentration of PM_{10} and $PM_{2.5}$ particles suspended in outdoor air.

This measurement is made using a photometer, utilizing the principle of light diffusion at tiny particles. The reflected light is registered by a photo detector and is increased with a low-noise amplifier to a level of 0 to 5 V. This output signal is a direct measure of particulate matter concentration.

The outdoor air is drawn in via a PM_{10} sampling head operating with a volumetric flow of 3.3 l/min. Particles greater than 10 µm in size will be segregated out inside this sampling head during intake. In its overall structure, this unit corresponds to the certified PM_{10} head used in the low-volume sampling device as per EN 12341:2014. The low-volume unit is designed for an air intake rate of 3.3 l/min (as compared with 38.3 l/min) and has been tested by the *Institut für Energie und Umwelttechnik IUTA e.V.* (Institute for Energy and Environmental Technology) with regard to its segregation characteristics.

The outside air thus drawn into the unit is then divided into two sub-streams in a virtual impactor located downstream.

A low-loss diverter unit (electromagnetic valve block) determines whether the aerosol from the auxiliary stream (enrichment mode) or from the main stream (normal mode) passes into the reflected light detector. The APM-2 thus determines the PM_{10} concentration when it is in the enrichment mode; the $PM_{2,5}$ concentration in the normal mode. The switching unit periodically admits filtered air to the reflected light detector in order to re-zero the instrument.

The photometer is installed in a thermally insulated case and kept at a temperature of 40 °C in order to eliminate any thermal effects on the photometer signal.

The data generated by the unit are stored internally on an SD card. Additionally, it is possible to transmit the data to a network computer using an integrated GPRS modem (optional).

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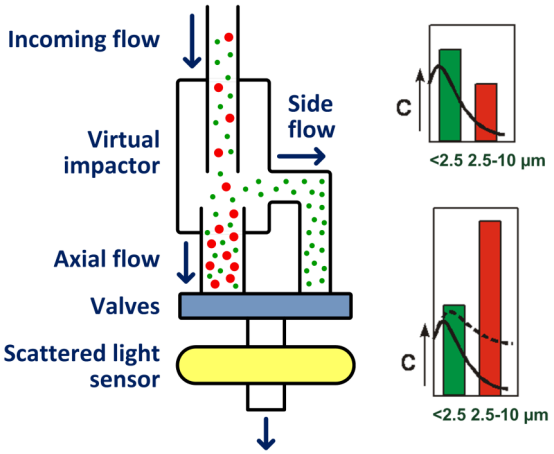
Measurement procedure used in the Air Pollution Monitor Type APM-2

The heart of the procedure for online measurement of environmental aerosols is a highly sensitive reflected light detector. The light emitted at stabilized intensity by a laser diode illuminates a measurement space defined by the beam path. The light scattered by all the particulates inside this measurement space is sensed at a 90° angle by a semiconductor photo detector. The signal is made available, following amplification, as a voltage signal (0 to 5 V). This signal is directly proportional to the mass concentration of the aerosol in the measurement space (0 to 1000 µg/m³).

The physics involved in reflection means that particles with diameters approximately equal to the wavelength of the beam, referenced to its mass, reflect the most efficiently. Thus this size fraction contributes the most to the overall signal.

The 680 nm wavelength used in this device is most sensitive to particles in the size range from 0.5 to 1 µm. It is this characteristic that imposes limits on using simple scattered light photometry to measure the PM_{10} concentration.

The measurement signal delivered by the reflected light detector is dominated by the $PM_{2.5}$ fraction.



Principle behind the virtual impactor

The complementary coarse fraction in the $PM_{2.5}$ to PM_{10} range contributes considerably less to the scattered light signal (in relation to its mass) and thus is underrepresented in the measurements. A simple process is used to compensate for this decreased sensitivity to the coarse fraction. The trick is to enrich the concentration of the fraction in the $PM_{2.5}$ to PM_{10} range by way of a „virtual impactor“ installed upstream from the photometer.

This enrichment is equivalent to increasing the sensitivity of the photometric equipment for the $PM_{2.5}$ to PM_{10} fraction. The principle is explained in the figure above.

Technical Data Air Pollution Monitor Type APM-2

Flowrate:	3.3 l/min
Sampling time:	Continuous
Power supply:	230 V, 50/60 Hz
Power consumption:	Approx. 80 VA
Measuring range:	0 ... 1000 µg/m³
Resolution:	1 µg/m³

Dimensions (without inlet and antenna):

Width	320 mm
Height	560 mm
Depth	270 mm
Weight:	Approx. 15 kg
IP classification:	IP 65

Ordering Information:

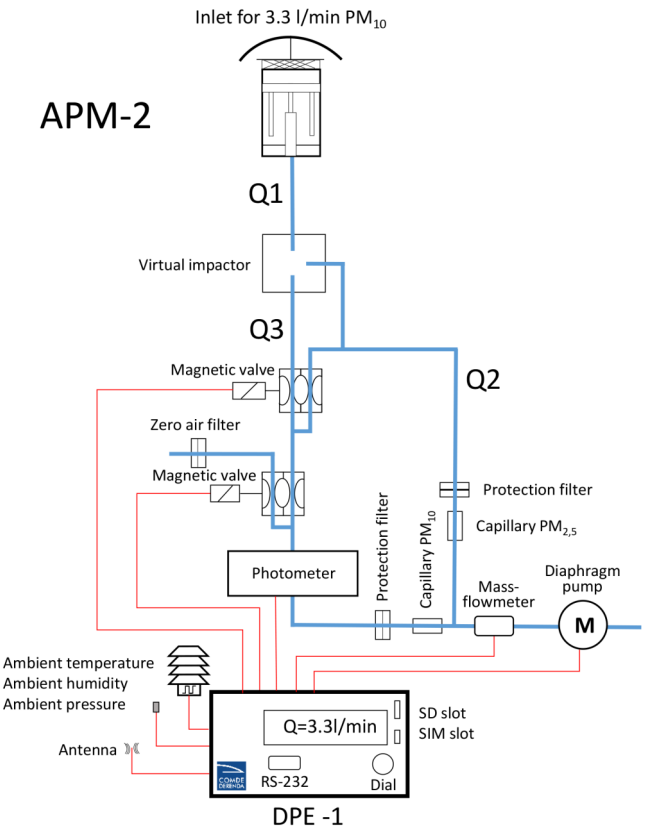
D120006	Air Pollution Monitor APM-2

Consumables:

D100101	Zero air filter
D100058	Pump protection filter

Scope of delivery:

Basic device APM-2, suction tube diameter 12 mm, inlet PM_{10} for flowrate 3.3 l/min without filter holder, 2 x SD card for data storage, 1xtransmission cable, 1 x USB SD card reader, calibration protocol, key and instruction manual



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