Environmental Monitoring Systems

SPM Sampling

Automatic Sampling System

PNS DM

with Double Magazine

for Sampling Particulate Matter $PM_{10/2.5/1}$

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Automatic Sampling System PNS DM

Automatic sampling system for continuously monitoring particulate matter concentrations (PM_{10}, $PM_{2.5}$ or PM_1) without manual filter changes

The system combines a low/medium volume sampler (LVS or MVS) and an automatic filter changer with intake tube and sampling inlet. It collects fine particulate matter on sampling filters according to EN 12341:2014 (PM_{10} and $PM_{2.5}$). For this purpose, it draws in ambient air and fractionates the airborne particles in a sampling inlet. The air containing the desired fine particulate fraction then passes through the filter, where the particles are collected and made available for subsequent gravimetric assessment or analysis. The automatic filter changer with Geneva drive facilitates sequential series of up to 18 resp. 24 sampling cycles. The volumetric flow rate is electronically controlled with an accuracy of ≤ 2 % deviation.

Design

Before operations commences, the electrical and pneumatic connections are made between low/medium volume sampler and automatic filter changer.

The **LVS** (Low Volume Sampler) and **MVS** (Medium Volume Sampler) consist essentially of a control unit (with electronic modules, SD card reader, and interfaces), vacuum pump, orifice plate and temperature and humidity sensors, contained in or attached to a stainless steel cabinet.

The **LVS 3.1** is equipped with a 4 m³/h rotary vane vacuum pump. The volumetric flow rate for sampling PM_{10} or $PM_{2.5}$ fractions is 2.3 m³/h; the maximum vacuum at the filter is 300 mbar. The maximum volumetric flow rate when using glass fiber filters is 3.5 m³/h.

The **MVS 6.1** is equipped with a 8 m³/h rotary vane vacuum pump. It can be operated with a maximum volumetric flow rate of approx. 5.5 m³/h. It is especially suitable for measuring semi-volatile organic compounds (SVOCs), and for use in conjunction with special filter materials (e.g. cellulose nitrate or Nuclepore filters). The maximum vacuum at the filter is 500 mbar. LVS and MVS function according to European directive EN 12341:2014.

The **automatic filter changer** consists of a filter changer unit with filter magazine mounting positions, filter magazines (capacity 18 or 24 filters) and aluminum intake tube (anodized, Ø 40 mm, length 800 mm, custom lengths available) in a stainless steel housing. A sampling inlet for fractions PM_{10}, $PM_{2.5}$, PM_1 or TSP and a Peltier cooling unit are optionally available.

The filter changer cabinet is vented in order to prevent moisture condensation and icing. The connection between the sampling inlet and intake tube is gas-tight. Three magazines and 36 resp. 48 filter cartridges come with each unit. When magazines are changed, one filter cartridge remains in the sampling position. The magazines also serve as portable containers.

Operating Principle

Before sampling begins, the desired settings are entered in the control unit, and the filter magazines are inserted into the filter changer. Once the operating cycle is activated, sampling takes place automatically according to the set parameters. During operation, the pump draws in air containing fine particulate matter through the sampling inlet of the filter changer. The dust particles are separated by size in the sampling inlet with impactor. The particles of the desired fraction are then deposited on the sampling filter in the sampling position.
At the end of the sampling period, the changer automatically changes the filters. The filter changer uses two transparent cylindrical magazines with a capacity of 18 or 24 filter cartridges each. The left (holding) magazine contains the unsampled filters. The filter cartridges are arranged on top of each other in the magazine. During the filter change operation, the unit transfers the lowermost filter cartridge from the holding magazine to the sampling position. At the same time, the filter cartridge located in the sampling position, and containing the sampled filter, is transferred to the right (sampled) magazine. The Geneva gearing allows the necessary complex movements to be performed simultaneously. A locking mechanism on the bottom of the magazine and tight covers keep the filter cartridges from falling out and prevent contamination with foreign particles.

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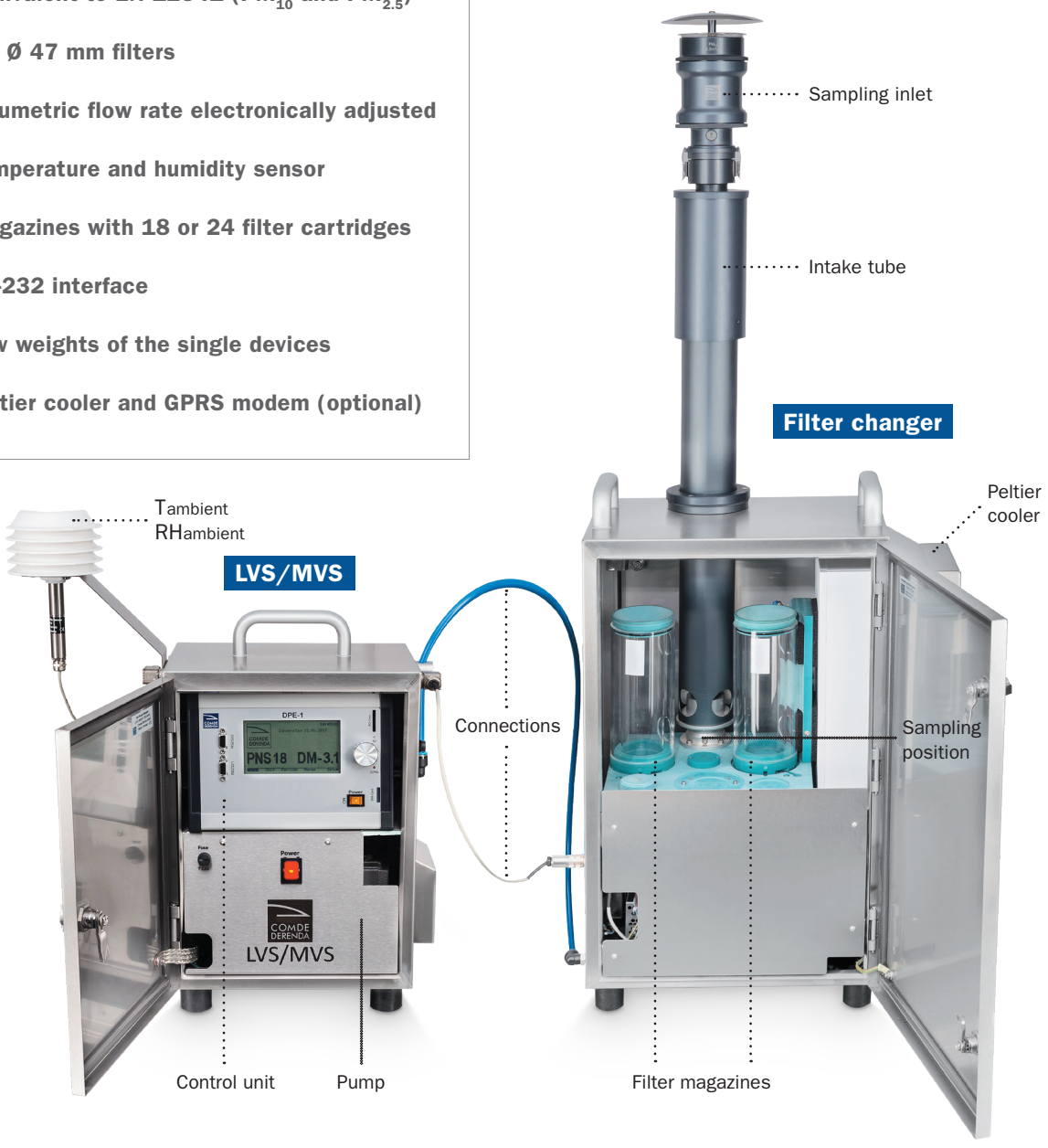
Automatic Sampling System PNS DM

- Equivalent to EN 12341 (PM_{10} and $PM_{2.5}$)
- For Ø 47 mm filters
- Volumetric flow rate electronically adjusted
- Temperature and humidity sensor
- Magazines with 18 or 24 filter cartridges
- RS-232 interface
- Low weights of the single devices
- Peltier cooler and GPRS modem (optional)



The volumetric flow rate is measured with an orifice plate and is electronically adjusted. The ambient climatic conditions are continuously monitored by temperature and humidity sensors. The optional Peltier cooler ensures that the sampled filter storage temperature in the unit does not exceed 23 °C. A function, which sends SMS notifications in case of exceptional events, is provided by the optional GPRS modem.

Various data captured during sampling are saved in the internal memory and can be additionally backed up on a SD card or transferred to a PC by way of the RS-232 interface or using the optional GPRS modem. Included in this data are serial number and filter number, sampling start/end/duration, mean volumetric flow rate, sampled volume, filter storage temperature and additional values.

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Technical Data Sampling System PNS DM

Types: PNS DM 18-3.1 / PNS DM 18-6.1 / PNS DM 24-3.1 / PNS DM 24-6.1

Volumetric Flow Rate	
LVS 3.1 (controlled)	1.0 ... 3.5 m³/h (Nm³/h)
MVS 6.1 (controlled)	1.0 ... 5.5 m³/h (Nm³/h)

Power Consumption	
LVS 3.1	approx. 240 VA
MVS 6.1	approx. 300 VA
Filter changer	approx. 50 VA (approx. 170 VA with cooling)

Sampling time	1 min ... 1000 h
Power supply	230 V, 50/60 Hz
Filter diameter	47 mm
Diameter of sampled filter surface	41 mm

Dimensions LVS/MVS (with handle and feet, without external sensor)	
Width	approx. 360 mm
Height	approx. 490 mm
Depth	approx. 290 mm***

Dimensions Filter Changer (with handle and feet)	
Width	435 mm / 535 mm*
Height	735 mm / 1400 mm**
Depth	315 mm / 350 mm***

Weight	
LVS 3.1	approx. 17 kg
MVS 6.1	approx. 19 kg
Filter changer	approx. 25 kg (approx. 31 kg with cooling)

Sound pressure level acc. EN 3744:2010 in 8 m distance	< 36 dB(A)
Operating temperature range	–30 ... +50 °C
Operating temperature range with Peltier cooler and set point value of max. 23 °C	–30 ... +35 °C
Operating humidity range	0 ... 100 % RH
IP classification	IP 55

*with cooling **with standard intake tube and sampling inlet ***with lock

For further information about the LVS/MVS please refer to the datasheet of these devices.

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