Environmental Monitoring Systems

SPM Sampling

Automatic Sampling System **PNS T-DM**

with Double Magazine for Monitoring Particulate Matter $PM_{10/2,5/1}$

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Automatic Sampling System PNS T-DM

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

The PNS combines a low/medium volume sampler (LVS or MVS) and an automatic filter changer in a stainless steel cabinet. It collects fine particulate matter on sampling filters according to EN 12341:2014 (PM_{10} and $PM_{2.5}$). For this purpose, a vacuum pump draws in ambient air, and the system 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 and two filter magazines facilitates sequential series of up to 24 sampling cycles. The volumetric flow rate is electronically adjusted with an accuracy of ≤ 2 % deviation.

Design

The system consists of the following principal components:

- Stainless steel cabinet with two lockable doors
- Control unit with electronic modules, SD card reader and RS-232 interface
- Rotary-vane vacuum pump
- Orifice plate
- Temperature and humidity sensor
- Filter changer unit with Geneva drive
- 3 filter magazines for 18 resp. 24 filters each
- Aluminum intake tube (anodized, polished inside, diameter Ø 40 mm, length 800 mm, custom lengths available)
- Sampling inlet (for particulate matter fractions PM_{10}, $PM_{2.5}$, PM_1 or TSP; optional)
- Peltier cooler (optional)
- GPRS modem (optional)

Type 3.1 is equipped with a 4 m³/h 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.
Type 6.1 is equipped with an 8 m³/h pump and 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.

The system 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 18th resp. 24th filter is used not for sampling but as a reference filter to collect possible passive particle deposits. 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 placed into the filter changer. Once the operating cycle is activated, sampling takes place automatically according to the set parameters. During operation, the vacuum pump draws in air laden with fine particulate matter through the sampling inlet, where the desired fraction is separated. The particles of the desired fraction are then deposited on the sampling filter in the sampling position.

At the end of a sampling period, the changer automatically changes the filters. The filter changer uses two of the three cylindrical magazines. The left (initial) magazine contains the unsampled filters. The filter cartridges are arranged on top of each other in the magazine. In the filter change operation, the unit transfers the lowermost filter cartridge from the initial 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 (storage) 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. The magazines retain the top cap even while in use in the system.

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Automatic Sampling System PNS T-DM

- **Reference device for PM_{10} and $PM_{2.5}$ acc. to EN 12341:2014, certified by TÜV Süd**
- **For Ø 47 mm filters**
- **Volumetric flow rate electronically adjusted**
- **Temperature and humidity sensor**
- **Magazines with 18 or 24 filter cartridges**
- **RS-232 interface**
- **Vented jacket tube**
- **Peltier cooler (optional)**

Scope of Delivery:
Basic device PNS T-DM with integrated sampler LVS 3.1 or MVS 6.1, mechanical filter changer, jacket tube Ø 80 mm, intake tube Ø 40 mm, 3 magazines with total 36 resp. 48 filter cartridges, 2 × SD card for data storage, 1 × transfer cable, 1 × USB SD card reader, calibration protocol, key and instruction manual

Accessories (Selection):

D100868	Sampling inlet PM_{10} (EN 12341:2014), flow rate 2.3 m³/h
D100870	Sampling inlet $PM_{2.5}$ (EN 12341:2014), flow rate 2.3 m³/h
D100871	Sampling inlet PM_1, flow rate 2.3 m³/h
D110166	Filter cartridge for Ø 47 mm filters
D100930	Calibration adapter

The volumetric flow rate is measured with an orifice plate and is electronically adjusted with an accuracy of ≤ 2 % deviation. 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 is saved in the internal memory and on a SD card and can be transferred to a PC via RS-232 interface or using the optional GPRS modem. This data includes serial number, filter number, sampling start/end/duration, mean volumetric flow rate, sampled volume, and filter storage temperature.

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Technical Data Sampling System PNS T-DM

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

Volumetric Flow Rate	
PNS T-DM-3.1 (controlled)	1.0 ... 3.5 m³/h (Nm³/h)
PNS T-DM-6.1 (controlled)	1.0 ... 5.5 m³/h (Nm³/h)
Accuracy	≤ 2 % deviation

Power Consumption	
PNS T-DM-3.1	approx. 300 VA / approx. 420 VA*
PNS T-DM-6.1	approx. 350 VA / approx. 470 VA*

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

Dimensions (with feet)	
Width	460 mm / 510 mm*
Height	1100 mm / 1620 mm**
Depth	300 mm / 330 mm***

Weight**	
PNS T-DM-3.1	approx. 52 kg / approx. 59 kg*
PNS T-DM-6.1	approx. 52.5 kg / approx. 59.5 kg*

Interfaces	
RS-232	2 x
SD card drive	1 x
GPRS modem (optional)	1 x

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

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