UniTec

LSPM10

Advanced Instrumentation Technology

Model LSPM10
PM_{10} / $PM_{2.5}$ Airborne Particulate Monitor and Sampler

- **COMPLIES WITH THE EUROPEAN DIRECTIVE EN 12341, REFERENCE METHOD: PM_{10} SAMPLING STANDARDS (2.3 m3/h) AND GRAVIMETRIC DETERMINATION OF THE PM_{10}**
- **UNIQUE PMT DETECTOR TECHNOLOGY**
- **HIGH SENSITIVITY FOR FINE PARTICULATE RANGE**
- **47mm SAMPLER FOR GRAVIMETRIC WEIGTHING**
- **EQUIPPED WITH UNITEC EUROHEAD (EN 12341) Sampling inlet with impactor for PM_{10} or $PM_{2.5}$**
- **VERY LOW DETECTION LIMIT (≈0.1 micrograms/m3)**

APPLICATIONS

- **ENVIRONMENTAL POLLUTION MONITORING**
- **INDOOR AIR POLLUTION**
- **INDUSTRIAL HYGIENE**
- **PARTICULATE CONTROL FROM CEMENT KILN**
- **QUALITY CONTROL FOR FOOD&BEVERAGE**
- **INDUSTRY AND PHARMACEUTICAL INDUSTRY**

47 mm filter Sampler Device according to the Directive EN12341

LSPM10 can be used as a sequential sampler with up to 16 membrane filters, being equipped with a gravimetric unit. It is possible to run the analyzer without interruption and get the particulate samples, strictly in accordance with EN12341/98 standards. LSPM10 can be programmed as a constant flow sampler, archiving sampling time, total volume sampled, average pressure and temperature during the sampling. The gravimetric weighing can be compared with the analyser's readings to check their accuracy.
The microprocessor of LSPM10 allows the use of LSPM10 as a constant volume sampler, storing in its memory the following data:

- Date and time of sampling start
- Date and time of sampling stop
- Date and time of starting of single sampling (for each filter)
- Data and time of stop of single sampling (for each filter)
- Selection of sampling flow
- Indication of average raw flow
- Indication of average normalized flow
- Total sampling time
- Total raw sampled volume
- Total normalized sample volume
- Input of standard sampling conditions (reference pressure and temperature)
- Average, minimum and maximum Pressure and temperature during sampling
- Flow normalization at standard values
- Maximum ΔT during sampling
- Maximum ΔP during sampling

This application allows the operator to correlate data measured by the LSPM10 analyser with the gravimetric weighting of the membrane filters contained in the sequential sampler module connected.
The sequential sampling module is connected to the continuous analyser through a flanged connector taking the air sampled out of the chamber. Theoretical determinations together with lab and field tests assure the perfect integrity of the sample that is not altered during the continuous analysis. LSPM10 manages all its functions automatically, including automatic filter changes according to the set time and set commands.

As option, the LSPM10 can be supplied without the gravimetric unit. In this case the LSPM10 is the best instrument to monitor particulate pollution due to vehicles by measuring the average of instantaneous values for each 6 minutes and the hourly average and 24 hours average.

The LSPM10 monitor can be supplied with a 47 mm diameter filter holder for a single sampling. In this case while the sampling is still managed by the microprocessor as previously described, the filter is only one and has to be manually changed.

PRINCIPLE OF OPERATION FOR CONTINOUS MEASUREMENT OF PM10 or PM2.5

Model LSPM10 is an instrument designed for the continuous monitoring of particulate, using the principle of orthogonal nephelometry. A constant flow controlled pump draws ambient air through the size selective sampling head of choice (PM10 or PM2.5) into the instrument, where particle concentration is derived by measuring the light scattered from an excitation beam. Using a special collimator device, the light beam is focussed in a spectral narrow band into the detector. LSPM10 uses a photo multiplier tube, a well-established technology, very stable and with good reliability. The signal is then output continuously to the microprocessor for data elaboration. Data are displayed as micrograms/nm3 on the front panel. The analyzer performs an automatic calibration of 20 seconds every 6 minutes. Potential drift is therefore compensated, ensuring high analysis stability.
MAIN TECHNICAL FEATURES:

- **High precision collimation**

The LSPM10 uses a system of grids for beam collimation. This unique technology provides a high optical throughput and the ultimate in stray light performance.
Because optical surfaces are not involved, contamination by dust, and the associated problem of zero shift, is avoided. Sensitivity is greatly enhanced by the high optical throughput. The design results in a far more compact instrument than all integrating type of nephelometers.

- **Orthogonal configuration:**

As any light concentration devices are not involved (filters, lenses etc), LSPM10 can assure perfect orthogonal beam conditions, where the cut-off a few degrees either side of 90 is virtually absolute. The advantage of this strict orthogonal geometry is that response with respect to particle size is better suited to measurement of urban ambient aerosols.
Partly because the LSPM10 ignores the dominant forward scatter lobe associated with larger particles, and partly because the PMT response restricts the wavelength of the light being measured to the blue, **the instrument has the main feature of being able to detect particles smaller than 0.1 micrometer.**
Having a good response at these small particle sizes is critical to accurate reporting of the so-called accumulation mode in the urban aerosol. This mode leads to the formation of particles in the size range 0.1 to 1um which are dangerous for the adverse health effects, and are usually known as PM2.5 standard. One of the main benefits of the orthogonal geometry of the LSPM10 is to provide a relatively uniform response over the entire particle size range of the accumulation mode.

- **Uninfluence of Large Particle Breakthrough:**

One of the advantages of LSPM10 is that the detector is relatively unresponsive to particles larger than 10µm, especially if used for environmental monitoring, where In the urban aerosol the major component is in the range 10 to 40µm arising from the resuspension activity of road traffic. Kerbside sites particularly are exposed to very high levels of resuspended dust which will breakthrough the PM10 or PM2.5 head to some extent, and be erroneously registered as fine particulate by a gravimetric device, whereas the LSPM10 will tend to ignore such contributions.

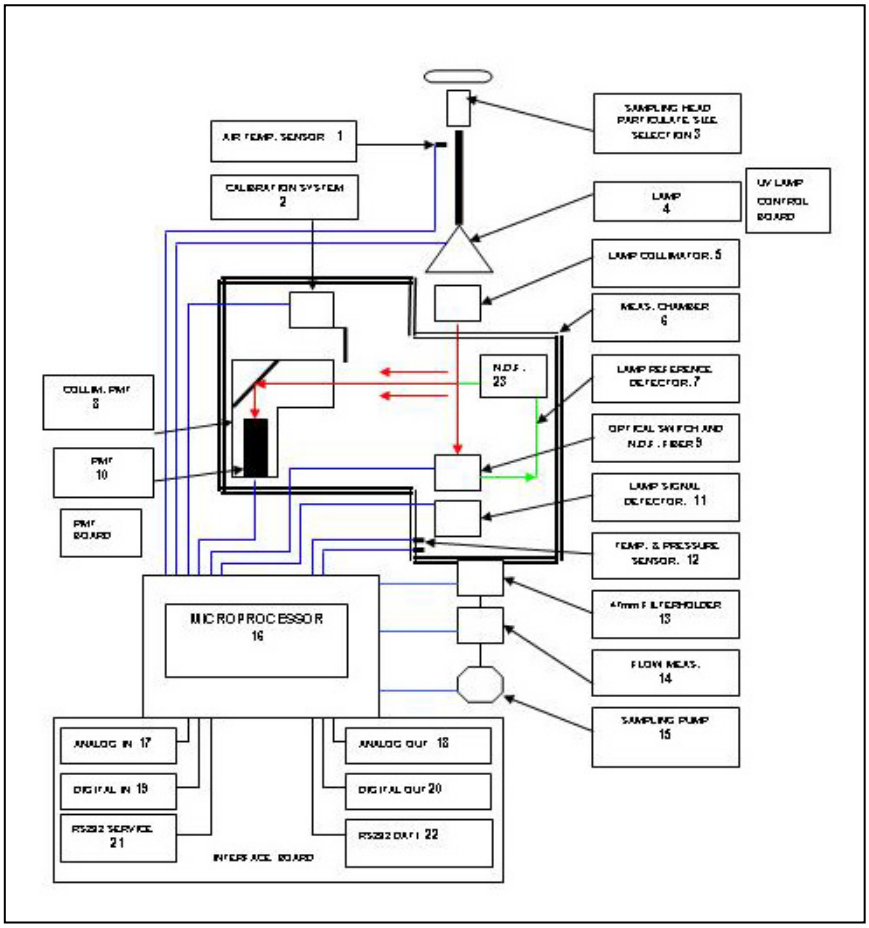
- **Better Handling of Volatiles:**

Continuous reading gravimetric devices require the sample inlet be heated in order to stabilize the filter element against mass changes mediated through the absorption of water vapour. The problem with this approach is that volatiles such as ammonium nitrate are not trapped and the instrument under-reads. Since ammonium nitrate is often an important constituent of the accumulation mode aerosol in urban situations, the magnitude of the error can be very considerable.
LSPM10, on the other hand, operates with its inlet only a few degrees above ambient. The heat generated by the light source, although is actively extracted by means of a heat filter, heat sink and fan, warms the inner part of the optical chamber.
Experience over a period of several years has indicated that the slight elevation of the instrument's temperature above ambient is sufficient to suppress errors from this source. This arrangement means volatiles will be accurately represented.

- **Electronics:**

Raw data acquisition, processing and archival storage are under control of a data management system, based on microprocessor technology that perform the following functions:

- data processing and display visualization
- LCD display as Interface for the operator
- Standard calibration using weighing comparison (gravimetric weighting comparison or monodisperse aerosol known concentration comparison) and by in-built reference optical filter
- Binary state check (span shutter on/off, lamp on/off, ref signal on/off etc.)
- Standard conditions sampling (constant flow control and normalized reading by temperature and pressure compensation)
- Real time diagnostic by starting data reference and running data comparison
- Data archiving in ASCII format ready to export for Windows programs (MS Excel, etc.) by serial port connection
- Alarm report with fault condition and/or preventive maintenance request (low PMT signal, calibration system fault or lamp life expired time)
- Data output by RS232 serial port and/or analogue signal (0-5V or 0/4-20 mA).



LSPM10 Layout

LSPM10 TECHNICAL SPECIFICATIONS

PRINCIPLE OF MEASURE:	Sampler module: LVS-PM10 sampler Monitor module: Ortogonal nephelometry (light scattering)
RANGE:	0-20.000 micrograms/m^3
RESOLUTION:	0.1 micrograms with analysis time of 6 minutes
LINEARITY:	Better then 0.1% in the range 0-1000 micrograms/ nm^3
ACCURACY:	Better then 1% (dimensional diameter particles range between 0.1 to 10 micrometers)
ZERO AND SPAN DRIFT:	Less then 0.1% automatically compensated during calibration
RAW ANALYSIS TIME:	30msec
MINIMUM SAMPLING TIME:	6 minutes, adjustable
SAMPLE FLOW:	Adjustable within the range 15-40 SLPM (other on request)
PUMP Module:	carbon vane vacuum pump, flow rate > 3 m3/h, with massflowcontroller and sample filter.
CALIBRATION:	Automatic at preset time or manual by the operator

MICROPROCESSOR

DISPLAY:	Alphanumeric display device
USER INTERFACE:	Front panel membrane keypad, IP 65 protection grade
SERIAL INTERFACE:	1 RS232 ports for host system connection and/or for service
ANALOG OUTPUT:	2 free configurable current or voltage output (max 20mA or 5V)
ANALOG INPUT:	2 free configurable input for external signal acquisition (max 20mA or 5V, galvanically isolated)
DIGITAL OUTPUT	2 fault (general or configurable dedicated)
DIGITAL INPUT:	2
DATA STORAGE:	Battery backup ram, 7 days of hourly average data

SAMPLING INLET

UNITEC EUROHEAD-PM10:	EN12341- PM10 Sampling inlet, 2.3 nm^3/h sample flow
PM2.5 :	PM 2.5 sampling inlet, max sample flow 3.6 nm^3/h (eg. 1 m^3/h or 2.3 m^3/h)

GENERAL SPECIFICATIONS

STORAGE CONDITIONS:	-10/+50 °C, max 90% U.R. non-condensing
OPERATING CONDITIONS:	0/ 40 °C max 90% U.R. non-condensing
SHOCK TEST:	*shock* 30G
SUPPLY:	110-240V, 50-60 hz (switch selection)
OPERATIONAL ABSORPTION:	6A at 220V 50 Hz
PUMP MODULE ABSORPTION:	2A at 220V 50 Hz
WEIGHT:	20 Kg
DIMENSIONS:	19" standard rack
CERTIFICATIONS:	CE *TÜV, as "candidate and reference sampler" according to European Directive EN 12341 (pending).*

UNITEC S.r.l.
Via C. Colombo 37/E
44100 FERRARA – ITALY
Tel +39 0532 731123 - Fax +39 0532 730537
E-mail: info@unitec-srl.com
Web Site: www.unitec-srl.com

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