Product Specifications

The Thermo Scientific 8500 Filter Dynamics Measurement System is a conditioning system used with the TEOM 1400ab. It provides a true mass measurement, accounting for volatile and non-volatile components of ambient particulate matter.

Thermo Scientific 8500 Filter Dynamics Measurement System

Key Features/Benefits

- Accounts for Nonvolatile and Volatile PM Components With Innovative Self-Referencing Methodology
- Hourly Mass Concentration Average Updated Every Six Minutes
- Scientifically Validated – Total Mass of Aerosol Chemical Species
- California Approved Sampler (CAS), PM-2.5 and PM-10 Regulations

The Challenge

The Thermo Scientific Filter Dynamics Measurement System (FDMS® unit) accomplishes the challenging task of accounting for both the volatile and non-volatile components of particulate matter (PM), and reporting the combination as a mass concentration result. This is done by measuring the volatile portion of the sample independently from the total incoming sample, and using this fraction in calculating the PM mass concentration.

The Technology

This sampling and measurement system is based upon a number of technologies successfully applied by Thermo, including the true-mass filter-based TEOM microbalance, a diffusion drying system, and a self-referencing technique to assess the volatile component of ambient PM. The FDMS unit provides a new PM measurement approach that offers the ability to quantify the PM mass concentration as it exists in ambient air.

The Information

As the name implies, the FDMS System takes into account the dynamics of PM that has been deposited on a sample collection filter, and how that material behaves over time. The device is designed to provide high-quality, representative PM mass concentration readings for both short-term averages (one hour) as well as 24-hour averages. The system's basic output consists of running 1-hour average mass concentration (in µg/m³) of PM-10, PM-2.5 or PM-1 updated every six minutes. The unit also computes the base mass concentration and reference mass concentration over the same averaging times.

8500 Filter Dyanmics Measurement System (FDMS)

Instrument Performance (3 l/min, 1s, stable conditions)
- Measurement Range: 0 to 5,000,000 µg/m³ (5 g/m³).
- Resolution: 0.1 µg/m³.
- Precision: ±2.5 µg/m³ (1-hour ave), ±0.8 µg/m³ (24-hour ave).
- Minimum Detectable Limit for Mass Measurement: 10 nanograms, 0.06 µg/m³ (1-hour ave).
- Accuracy for Mass Measurement: ±0.75%.

Flow Control
- Two mass flow controllers (0-5 and 0-20 l/min) with 1% of full-scale accuracy.
- Active volumetric flow control of sample stream using ambient temperature and pressure sensors.
- Mass concentration expressed either in standard or actual terms (user selectable).

Sample Conditioning System
- Filter Dynamics Measurement System (FDMS) dryer contains specially-designed Nafion® tubing inlet on the main flow to minimize potential for particle loss. The dryer lowers the main flow relative humidity, and allows for mass transducer operation at 5 °C above the peak air monitoring station temperature.
- Purge Filter Conditioner contains a heat exchanger that maintains the temperature of the main air flow and particle filter at 4 °C.
- An integrated humidity sensor that follows the SES dryer measures the humidity of the main flow line to determine the drying efficiency.

Data Averaging and Output

The system computes mass concentration information as mass concentration (sample MC adjusted by purge MC), volatility coefficient, volatile mass concentration and nonvolatile mass concentration.
- Real-time Mass Concentration Averages: 1 hour running average, updated every six minutes.
- Long-Term Averaging: 1, 8 (user selectable), 12 and 24 hr, updated every hour.

Operating Range
- The temperature of the sampled air may vary between -30 and 50 °C. With the exception of the size-selective inlet, the instrument must be weather protected within the range of 8 to 25 °C.
- Total flow rate of 16.7 l/min (1 m³/h), with a main flow rate of 3 l/min and a bypass flow rate of 13.67 l/min.
- Temperature of mass sensor and internal sample tube: 5 °C above the peak station temperature (default 30 °C, with set point range of 30 to 40 °C).

Data Storage
- Internal data logging of 1 to 8 user-specified variables; capacity of up to 10 weeks of hourly mass concentration data.

Filter Media
- Collection filter: Pallflex TX40, 13 mm effective diameter. Must use molded-TEOM style filter cartridge.
- Purge filter: 47 mm diameter filter housed in an FRM-style molded filter cassette, maintained at 4 °C. Suitable for collecting and archiving time-integrated particulate matter samples for subsequent laboratory analysis.

Software and Documentation
- RPCOMM and RPDATA software downloadable from the Thermo web site to retrieve and view data on a number of computer platforms.
- Operating manual.

Data Output and Input
- Four-line display on control unit.
- RS232 serial connector for two-way communication with network and computer devices using the AK protocol.
- 3 User-Defined Analog Outputs (0-1, 0-2, 0-5 or 0-10 VDC).

Dimensions and Power Requirements
- FDMS Kit: 28 cm (11") W x 17.8 cm (7") D x 55.9 cm (22") H, 10 kg (22 lb), 1 A @ 120 VAC, 0.5 A @ 240 VAC.
- Sensor unit: 35.6 cm (14") W x 28 cm (11") D x 99 cm (39" H), 18.2 kg (40 lb), power from control unit.
- Control unit: 43.2 cm (17") W x 38.1 cm (15") D x 22.9 cm (9") H, 14.6 kg (32 lb), 1 A @ 120 VAC, 0.5 A @ 240 VAC.
- Pump: 15.3 cm (6") W x 28 cm (11") D x 20.4 cm (8") H, 7.3 kg (16 lb), 4.25 A @ 120 VAC, 2.25 A @ 240 VAC.
- System height: sensor unit only is 99 cm (39") in height, total system including sensor unit and FDMS kit is 160 cm (63") in height.
- Electrical cables between FDMS Unit and TEOM control unit: 10 m valve control cable and 10 m status cable.

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