DEKATI FPS-4000
Fine Particle Sampler

- Automotive exhaust and combustion aerosol dilution
- Versatile sampling system
- Real-time dilution condition control

DEKATI
Excellence in Particle Measurements

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Fine Particle Sampler

Dekati Fine Particle Sampler is a guaranteed solution for diluting and conditioning aerosol and gaseous samples for measurement instruments. The two stage dilution system features unmatched versatility with applications reaching from automotive pre- and post after treatment measurements to nucleation studies.

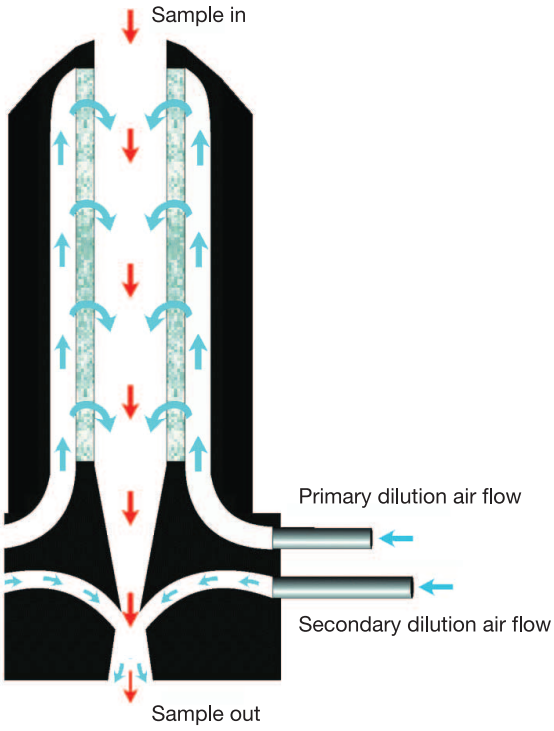
Operation Principle

A raw sample is extracted from the source (i.e. exhaust or flue gas) by using a stainless steel probe. The sample is subsequently diluted in two stages employing a perforated tube and ejector dilution, respectively.

The primary dilution takes place within the perforated tube where the raw sample mixes with dilution air forced through small pores in the perforated tube wall. The perforated tube is housed within the primary diluter body which can be heated or cooled. The dilution ratio of the primary dilution stage can be adjusted by changing the dilution airflow into the primary diluter.

The secondary dilution stage is an ejector pump which draws the sample from the primary dilution stage and dilutes it further. The diluted gas exiting the ejector diluter is always at an ambient pressure and temperature regardless of the initial raw sample gas characteristics. The ejector diluter dilution ratio has three options: low, medium or high.

Dilution temperatures and pressures are measured in real-time by a control unit enabling second-by-second dilution ratio calculation which takes changes in raw sample properties directly into account. The dilution air flows are regulated with a valve unit which contains critical orifices for accurate and repeatable control. Each FPS-4000 is individually calibrated by gas flow measurements which span all operating conditions.
The dilution ratio calculation result is saved in real-time along with temperature and pressure data in an easily accessible form for post-processing of the data. Analog output of the dilution ratio is also available for easy integration into existing data logging systems.



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Applications

FPS-4000 is a flexible tool for any aerosol dilution and conditioning tasks. The applications include:

- Automotive exhaust dilution
  - Pre- and post after-treatment devices
- Power plant flue gas dilution
- Small-scale stationary source dilution
- Aerosol transformation research for all sources
  - Nucleation/Condensation studies
  - Agglomeration studies

FPS Advantages

Business advantages

- The most versatile sampling system commercially available – Single device for all dilution tasks
- Can be connected pre- and post after-treatment systems with an adjustable dilution ratio – Increase efficiency and repeatability by using the same setup in all measurement locations
- Can be integrated to existing data logging systems – Save time and money with easy data collection

Technical advantages

- Real-time dilution ratio calculation and data storage
- Adjustable dilution ratio and dilution temperature
- Control of all features from user-friendly PC-software
- Sophisticated handling of volatile vapours
  - Removal with heated dilution
  - Nucleation tendency studies with cooled dilution and a residence time chamber
  - Removal with Dekati Thermodenuder
- Calibrated with traceably calibrated gas and pressure flow meters
- Extremely low losses – no loss correction needed
  - Particle residence time within the system < 0.5 seconds
  - Particles travel on a straight line, no bends or moving parts

Accessories

Full automotive sampling setup FPS-4403

Includes the following items for a comprehensive dilution and conditioning system for automotive and any small-scale application:

- DH-1723 Pressurised air heater for dilution air
  For heated dilution air up to 350°C
- DH-1423 Probe heater
  For heating the dilution probe
- FPS-4001 Pressurised air filtration and drying unit
  For conditioning the dilution air to eliminate unwanted artefacts
- FPS-4005 Automatic pressure controller
  For automatic control of the FPS operating pressure
- ELA-424 Mobile rack for Dekati instruments.
  For easy transfer of instruments between measurement locations

Available for 110 and 230V

Full stack sampling setup FPS-4503

Includes the following items for a comprehensive dilution and conditioning system for stack or large duct sampling:

- DH-1723 Pressurised air heater for dilution air
  For heated dilution air up to 350°C
- FPS-4230 Stack heater, pre-cut cyclone and one nozzle for isokinetic sampling
  For large stacks, includes a 2.5 µm-cut mini-cyclone
- ELA-419, set of 5 sampling nozzles for the mini-cyclone
  For isokinetic sampling
- FPS-4001 Pressurised air filtration and drying unit
  For conditioning the dilution air to eliminate unwanted artefacts
- FPS-4005 Automatic pressure controller
  For automatic control of the FPS operating pressure
- ELA-424 Mobile rack for Dekati instruments. Can house either FPS+DMM or FPS+ELPI, must be specified when ordering.
  For easy transfer of instruments between measurement locations
- ELA-441 Extension cable set (8m)
  For increased flexibility in placement of the sampling probe

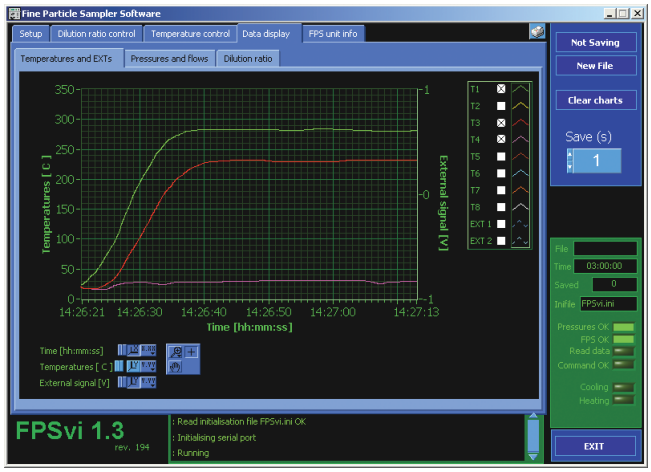
Available in 230V and 110V

Dekati Thermodenuder ELA-230

Dekati Thermodenuder always guarantees a dry soot mode of particles for measurement from automotive exhaust sources. The Thermodenuder removes volatile vapours and particles by using a combination of heating and active carbon.

Residence Time Chamber ELA-400

Residence Time Chamber is used in nucleation studies to give the nucleated particles time to grow into the measurement range of the measurement instruments. The Residence Time Chamber is directly applied between the primary and secondary dilution stages.



Software

FPS-4000 is fully controlled via an RS-232 port by using the LabView-based FPSVi programme. FPSVi features easy and simple control of dilution ratio and temperature through a user-friendly interface. All measured and calculated information is stored in a user-defined file for easy access. Additional analogue inputs and temperature signals can also be logged into the FPSVi save file.

Specifications

Dilution specifications

Dilution ratios*	1:20-1:200
Dilution temperature	0-350°C
Primary diluter	1:3-1:20
Secondary (ejector) diluter	1:7-1:15
Raw sample temperature	0-600°C
Raw sample pressure	750-2000 mbar abs
Purified pressurised air for dilution	
Particle concentration	recommended < 100 / cc
RH	non-condensing at –40 °C
Pressure (absolute)	max. 9 bar abs min. 6 bar abs
Operating pressure	4.5 bar abs
Flow rate (at 1.013 bar, 20°C)	max. 220 lpm
Flows (at 1.013 bar, 20°C)	
Sample flow	0-10 lpm
Primary dilution air flow	2-40 lpm
Secondary dilution air flow	40-140 lpm
Diluted sample flow	60-160 lpm
Cooling agent pressurised air or water	
Pressurised air for cooling	3-8 bar, 600 lpm, moisture free

*Dilution ratio displayed within +/- 10% of reading
*Dilution ratio over 100 achievable only with a stable inlet pressure
*Dilution ration adjustable in discrete steps with at least one step between 100 and 200

Data acquisition

Computer requirement	Pentium processor, 16 MB RAM, MS-WINDOWS NT 4.0™, XP™ or 2000™
PC/Laptop connection	RS232
Analog input	2 x 1-5 V
Analog output (dilution ratio)	1-5 V
K-type thermocouples	8 channels
Pressures	2 x 4-20 mA

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Specifications

Coolers and heaters

Primary probe cooler	Vortex type cooler (Accessory)
Probe heater	350 W
Dilution air heater	1000 W
Thermodenuder heater	350 W

Hardware Specifications

Dimensions	560 mm x 410 mm x 310 mm (can be mounted in a 19” rack)
Weight	30 kg
Material	AISI 316
Power consumption	1 earthed electrical power outlet, Max. 2000 W
Connections Probe inlet	 NW40 flange or 6 mm drilled through pipe connector (eg. Swagelok®, Gyrolok®)
Probe outlet	NW40 flange or 1-5 pcs. of 12x1 mm tube
Pressurised air inlets	Quick connector for 10 mm plastic tube

Patent Pending

The Dekati Fine Particle Sampler has been specially designed to comply with the standard criteria of the European Union’s DG-TREN Particultes Project for harmonized particle measurements. It incorporates the requirements of modern particle sampling instruments for both scientific research and industrial quality control measurements.

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Dekati Ltd. is specialized in the design and manufacture of innovative fine particle measuring and sampling devices. Since its founding in 1994, Dekati has become the technological market leader in producing fine particle measurement instrumentation for various applications and hundreds of customers.

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