

# SWAM 5a Dual Channel HM Monitor

ATMOSPHERIC PARTICLE MEASUREMENT SYSTEM  
SEQUENTIAL SAMPLER AND TWO-CHANNEL MASS MONITOR



**SWAM 5a Dual Channel Hourly Mode (HM) Monitor** is an innovative automated system, designed and manufactured by FAI Instruments, for sampling and measuring particulate matter (PM) suspended in ambient air.

Combining the proven beta absorption measurement technique with a dual-channel sequential sampling technology, the instrument provides both PM<sub>10</sub> and PM<sub>2.5</sub> mass concentration values every hour simultaneously.

Performing two ancillary measures - measurement of beta flux in air and measurement of beta flux through 'spy' filters - allows potential errors associated with the beta method to be identified, quantified and removed.

- In accordance with Legislative Decree 155/2010
- Certificate equivalent to the reference method for sampling and measurement of PM<sub>10</sub> and PM<sub>2.5</sub> described in EN 12341:2014 - TÜV Report 936/21215783/A of 7 February 2012 & TÜV Communication of 20 October 2014
- Certificate in accordance with the requirements of EN 15267:2009 (Part 1 and Part 2), as provided for by Legislative Decree 250/2012 - TÜV Communication of 13 March 2012
- Certified to MCERTS performance standards - Sira Certificate MC150272/01 of 2 March 2015

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## ATMOSPHERIC PARTICLE MEASUREMENT SYSTEM

### Dual-channel sequential sampling

- **Two distinct and parallel sampling lines**

Configurable with heads of different particle sizes (PTS, PM10, PM2.5 and PM1).

- **Operating range**

2,3 m<sup>3</sup>/h (with equivalence certification) or 1 m<sup>3</sup>/h.

- **Particle collection filters diameter 47 mm**

- **Blank Filter Loading Containers (Loader)/exhaust sampled filters (Unloader)**

The capacity of the filter loading/unloading containers is 96 filter holders.



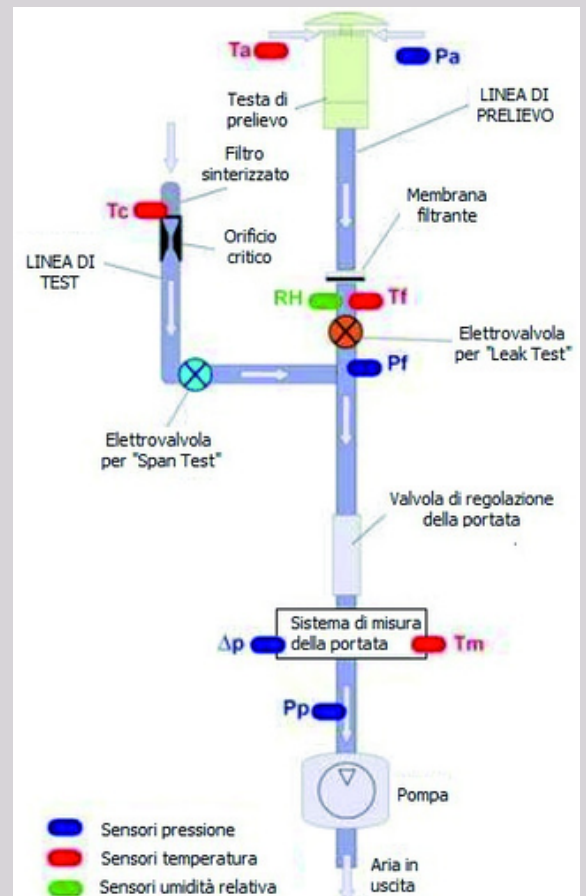
**The two sampling lines are independently controlled and operate simultaneously. Compared to other continuous PM measurement systems, the SWAM 5a Dual Channel HM Monitor provides a fully representative sampling period: the air is actively sampled for more than 57 minutes during each hourly cycle. The determination of the mass of particulate matter collected on the filter is performed immediately after the sampling period, without interruptions or downtime.**

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## ATMOSPHERIC PARTICLE MEASUREMENT SYSTEM



Each filter is inserted in a filter holder made up of two circular discs that, by pressure locking together, hold the filter inside them, making them easy to handle and guaranteeing their preservation.



Schematic diagram of the pneumatic circuit (for pick-up line)

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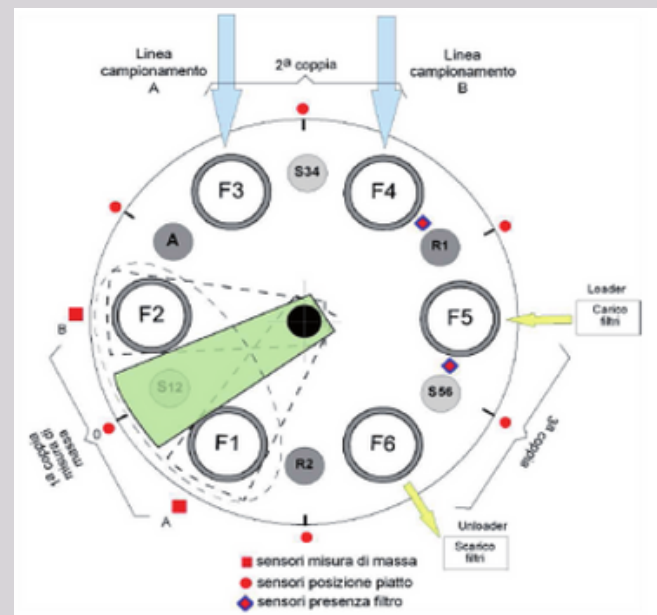
## ATMOSPHERIC PARTICLE MEASUREMENT SYSTEM

### Multi-step measure

- **Air Counting**  
Estimation of air density variations
- **Dark Counting**  
Measuring background radiation in air
- **Blank Counting**  
Measuring the filter before sampling
- **Natural Counting**  
Measuring background radiation in the sample
- **Collect Counting**  
Mass measurement of the collected sample



### Filter positioning revolving plate



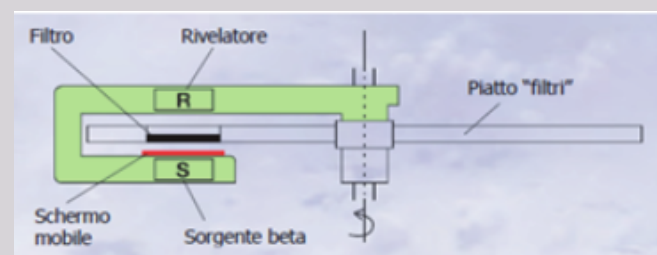
### Revolving plate

The revolving plate allows the placement of 6 operational filters ('F') and 3 sighting filters ('S'), as well as 2 reference membranes ('R') used to verify the calibration of the mass measurement system. There is also a hole ('A') on the plate to allow measurement of the beta flow in air. Rotating the platter allows the filters to be brought into a plurality of successive positions, required by the filter loading, sample accumulation and measurement, and filter unloading cycle.

### Mass measurement system

The beta source/detector system (Geiger-Müller counter) is placed on a mobile arm that keeps the two elements mechanically constrained and integral with each other, so as to minimise geometric variations and ensure highly repeatable mass measurements. The arm rotates around the axis of the filter positioning plate, allowing the source and detector to assume three different positions, relative to the plate itself, in order to perform the intended measurements. A movable screen is also applied to the arm, interposing itself between the source and detector when required by the measurement sequence, shielding the former with respect to the latter and preventing the radiation emitted by the source from passing through any filter interposed between them.

### Side view of the Source/Receiver system

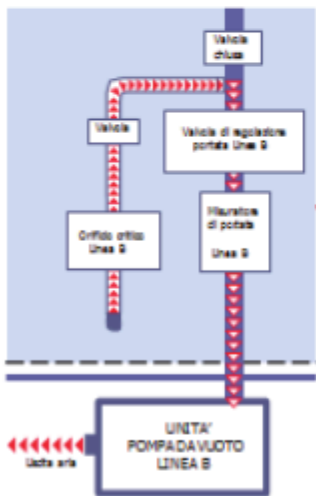


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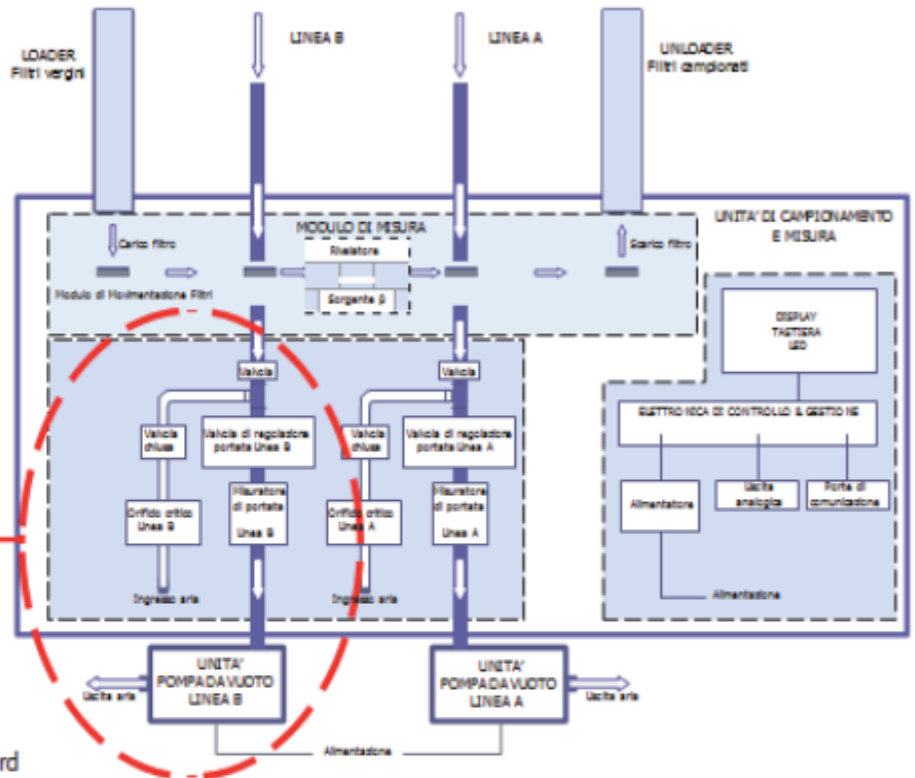
## ATMOSPHERIC PARTICLE MEASUREMENT SYSTEM

### Control and Quality Assurance

- Automated calibration checks of the flow measurement system of each line
- Automated checks on the tightness of the pneumatic circuit of each line
- Automated calibration checks of the two-point mass measuring system
- Active monitoring of pneumatic integrity
- Active monitoring of analytical components
- User-settable alarm thresholds for quality control parameters



Controlli automatici della portata realizzati da standard di trasferimento interno (uno per linea)



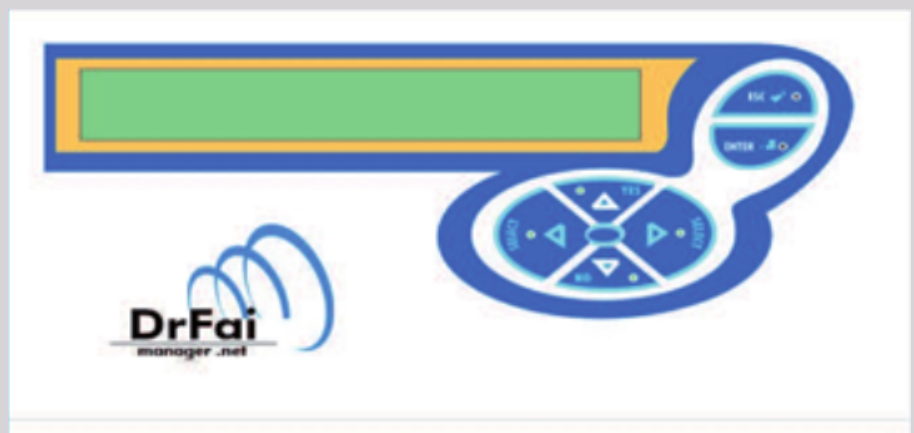
Data validation is performed automatically by the instrument based on approximately 60 measured and stored parameters for each channel during each measurement cycle. When the instrument's behaviour is outside the user-defined limits, immediate notification is given, resulting in higher quality and data collection rates.

### Connectivity & Remote Access

- Digital Communication
- Remote communication software

All raw and calculated data are stored in the instrument's internal memory (Buffer Data) for diagnostic and data analysis purposes.

Data can be accessed locally or remotely via external data logger or Dr-FAI-Manager software.



The Dr-FAI-Manager software provides secure local and remote access and control of the SWAM 5a Dual Channel HM Monitor.



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## ATMOSPHERIC PARTICLE MEASUREMENT SYSTEM

### Technical Specifications

Mass thickness measuring operating range	Total mass thickness (filter medium + particle material film) up to 10 mg/cm <sup>2</sup>
Resolution	0,1 µg/m <sup>3</sup>
Measuring range	0-2000 µg/m <sup>3</sup>
Beta source	<sup>14</sup> C nominal activity of 3,7 Mbeq (100 µCi)
Operative range	Programmable in range 0,8 - 2,5 m <sup>3</sup> /h
Reproducibility of flow measurement	1% of the read value
Relative uncertainty of flow measurement	2% of the read value
Flow rate control	Automatic with stepper motor-driven control valve. Flow control stability better than 1% of the required nominal value
Maximum allowable pressure drop	40kPa - For pressure drops above 40kPa, reaching the nominal operating flow rate of 2,3 m <sup>3</sup> /h is not guaranteed
Loading/unloading container capacity	Filter holders
Filter holders	Standard supply for membrane filter diameter 47mm
Interfaces	<b>User Interface:</b> LCD display and membrane keyboard. <b>Serial Interfaces:</b> RS-232 port for local PC connection and RS-232 port for communication via GSM/PSTN modem
Service gases	Compressed air, supplied by auxiliary compressor included with the instrument. Operating pressure: 200-300 kPa
Auxiliary compressor capacity	12 l/min on 300kPa
Power supply	230Vca (± 10%) 50Hz
Electrical power input	1200 Watt (max)
DC power supply (in the event of mains power failure)	2 buffer batteries 12V 3,5 Ah - Autonomy for completing mass measurements and filter handling
Operating conditions (inside the installation booth)	Relative humidity: < 85% condensation-free
Size (LxPxH)	<b>Sampling and measuring units:</b> 430x540x370 mm <b>Pump units (each):</b> 200x320x200 mm <b>Compressor unit:</b> 180x320x200 mm
Weight	<b>Sampling and measuring units:</b> 36 Kg <b>Pump units (each):</b> 10 Kg <b>Compressor unit:</b> 18 Kg

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