Outstanding features of the Aer series

Due to the principal of operation and the counting statistics are there only negligible differences in terms of achievable detection limits, uncertainties and response times between spectroscopic air samplers on the market. The counting efficiency of a parallel filter/detector arrangement of the same size results always in a counting efficiency of approximately 20% and the detectable activity depends exclusively on the adjusted flow rate. What makes the difference between the Aer family and instruments of other manufacturers? This document explains why we have constructed some details more extensive than our competitors.

Regulated air flow

Why necessary?

The collection of aerosols is a very complex mechanism. Particles in an air stream undergo many different processes for deposition at surrounding surfaces (tubes, detector housing etc.), depending on geometry of the sampling equipment, particle size and air velocity. Therefore, if flow rate drops down over the filter life span, the depletion process can change significantly resulting in result deviations.

Solution

All instruments of the Aer series offer a regulated air flow. Two different technologies can be ordered alternatively. The first one is the direct regulation of the pump by a controlled frequency converter. In that case the pump runs usually at lower speeds reducing abrasion and increasing the maintenance intervals. The second solution is a controlled servo valve which allows the user to connect the instrument to internal/external pumps or any other vacuum supply.

Large effective filter diameters and detector areas

Why necessary?

The life span of the filter depends on the collection capacity for particles which is direct proportional to the open filter area. Furthermore the air resistance of a large filter is lower which reduces the pressure drop across the filter. This prevents filter break at the one hand and deep penetration of particles at the other hand.

Solution

The open filter diameter of all Aer instruments is 40mm. Because the area depends on the square of the diameter, our open surface is 2.6 times higher compared with a 25mm diameter filter of competitors. To ensure optimum counting efficiency, the detector should have the same diameter like the filter. We use a 1200mm²-detector which fulfils this condition and still offers a low detector noise for a low beta threshold.

Active filter sealing mechanism

Why necessary?

In common air samplers with moving filters, the tape is simply pressed against the air inlet by the force generated by the pressure drop across the filter. The sealing is only performed at the edge of the inlet. For mechanical stability, filter tapes are reinforced by fibres or fabric at the backside which results in small gaps at the sealing edge. Therefore a portion of the air stream can bypass the filter even if the system is installed in a sealed cassette. The higher the dust load of the filter the higher will be the portion which bypasses the filter.

Solution

The Aer instruments are equipped with a movable air inlet. The air inlet moves down and frees the filter when the tape steps forward. As soon as the air flow is applied again the air inlet will be pressed against the filter backside by a pneumatic mechanism. A soft rubber sealing between air inlet and filter closes the gaps due to fibres or fabric resulting in absolute tightness.

Microcontroller system instead computer based solution

Why necessary?

Most of competitor solutions are based on embedded computers with standard operational systems. These operational systems need a significant time to boot resulting in a delay from powering to ready for operation state. Operational systems can have leakages for cyber-attacks or viruses especially if they are no longer maintained by the provider. Take in account that the period of usage of such an instrument is normally longer than the product updates in the world of computers.

Solution

The core of all Aer instruments is a micro-controller based platform developed by SARAD with flashed firmware without any file operations. All Aer instruments are ready for operation within three seconds after power up.

Aerodynamic optimized design of sampling unit (types with tube connection)

Why necessary?

One of the most important depletion processes is the impaction of particles if the air stream will change the direction. Especially edges and angles lead to significant particle lost. In most common designs with air inlet tube and detector in axial arrangement the air stream has to pass the edge of the detector housing in a 90° angle before it reaches the filter.

Solution

The air stream is guided smoothly through the bended tube connector (aerodynamic optimized with respect to flow rate, bending radius and tube diameter) to the slot between detector and filter. The shape of the cross section changes gradually from round to square without changing the area directly in front of the slot between filter and detector. That means, the air penetrates into the slot sideward and no change of direction is required.

Easy and quick access to activated filters

Why necessary?

Generally, activated filter will be investigated in detail by advanced alpha spectroscopy in a laboratory. That means, the activated filter must be cut from the tape. This work must be done quick and easy without interruption of the sampling process. Hermetical sealed filter cassettes require in many cases an extensive opening process to ensure the required sealing.

Solution

Mechanics and tape of the Aer is un-pressured are freely accessible. Only the actual used filter is placed in the closed air loop. After a filter step, the activated filter is placed in a position where it can be cut without interruption of the sampling process.