Application Note

Continuous Particle Monitoring

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Continuous Particle Monitoring

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In order to determine the best system for continuous monitoring of particles in a cleanroom, you should understand the two types of continuous particle monitoring systems.

Real Time Particle Monitoring

Real time particle monitoring involves the use of a single particle counter or particle sensor at a specific location.

This sensor is dedicated to monitor particles only at this specific location. Every event would be detected and counted. There are no gaps in the particle counting data. Particles are monitored in particles per cubic foot or particles per cubic meter. This system is best used at critical locations where events can happen at any time. Critical or very sensitive operations can be monitored.

Several types of particle counters can be used.

- Stand Alone Counter: Dedicated counter with display and vacuum pump built in.
- Remote Particle Counter: No display; vacuum for sampling is supplied via Process Vacuum or a separate pump dedicated to particle counting.

Real Time Particle Monitoring Advantages

- Continuous detection of all particle events.
- Good for critical or sensitive monitoring at lower detection limits <0.1 micron.
- Good for equipment monitoring for failure and Preventive Maintenance (PM) at higher detection limits <0.2 micron.
- Immediate notification or alarming of yield destroying particle excursions.
- Allows for emergency reaction to particle events.
- Immediate feedback to operators and technicians when procedures are not being followed.
- Essential to look at rooms during shift changes and evacuations where traffic may be higher.
- Immediate feedback after shut down/evacuation to verify if the area is in specification.

Sequential Particle Monitoring

Sometimes referred to as Pneumatically Multiplexed Particle Counting. This involves the use of a single particle counter to monitor multiple points. This is accomplished by adding a sequential manifold sampler that connects the particle counter to several different sample tubes. Each tube is sampled in sequence. Once a tube is sampled, the manifold switches to the next tube to be sampled. During this change the particle counter stops counting until the change is complete, then delays to allow any air from the previous sample to be purged. Air is continuously being pulled through all sample tubes via a blower. This avoids any "Air Hammering" that may free particles in the sample tubing from the start and stop of the air flow. Particles are monitored in particles per cubic foot or particles per cubic meter.

The frequency of each sample is based upon the number of points. Typically, each location is sampled for one minute then purged for ten seconds as the sampling arm moves to the next location. Based on this, the following table can be used to determine sample frequency at a given point.

Table 1: Frequency of Samples in a Manifold Particle Monitoring System

Number of Ports Sampled	*Time Between Samples at the Same Port	* Number of Samples/Day at Same Location
10	10 Minutes, 40 Seconds	135
12	13 Minutes	110
16	17 Minutes, 40 Seconds	81
24	27 Minutes	53
32	36 Minutes, 20 Seconds	39
40	45 Minutes, 40 Seconds	31

Number of Ports Sampled * Time between Samples at same port = Number of Samples/day at same location

*Based Upon 60 Second Sample, 10 Second Purge Between Samples

Manifold Particle Monitoring Advantages

- Allows for fewer counters to be used to cover a specific area
- Decreased costs allow greater sensitivity per cost
- Central location of the counter allows for easier service
- Reduced calibration costs
- Excellent for Cleanroom trending overall performance

Table 2: Real Time vs. Sequential Particle Monitoring

Item	Real Time Particle Monitoring	Manifold Particle Monitoring
Single Event Detection	Detects every particle event in the cleanroom no matter how short the duration.	Only detects events that occur over a longer duration. Short events are missed and reported when sampled.
Cost	More expensive for the same coverage because individual counters are used. The lower the detection limits, the higher the cost.	Lower cost for the same coverage. Can allow for lower detection limits (smaller particle size).
Sample Interval	Continuous	See Table 1
Installation	Sensors and sensing points can be located anywhere. Tubing distance is not a factor.	~30 meters between sample point and particle counter.
Critical / Sensitive Location Monitoring	Detects everything, no gaps in the data.	Detects only trends. Can miss single events.
Calibration	More sensors, more calibration.	Fewer sensors, less calibration.
Service	More sensors, greater need for service.	Fewer Sensors, less service needed.

Figure 1

Real Time Remote Particle Monitoring System

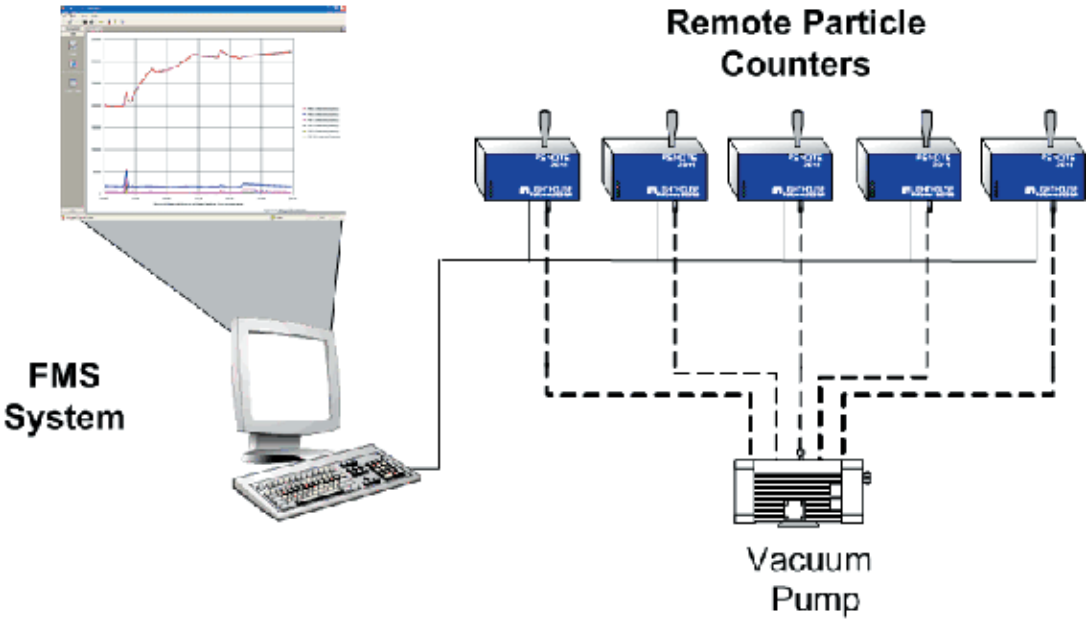
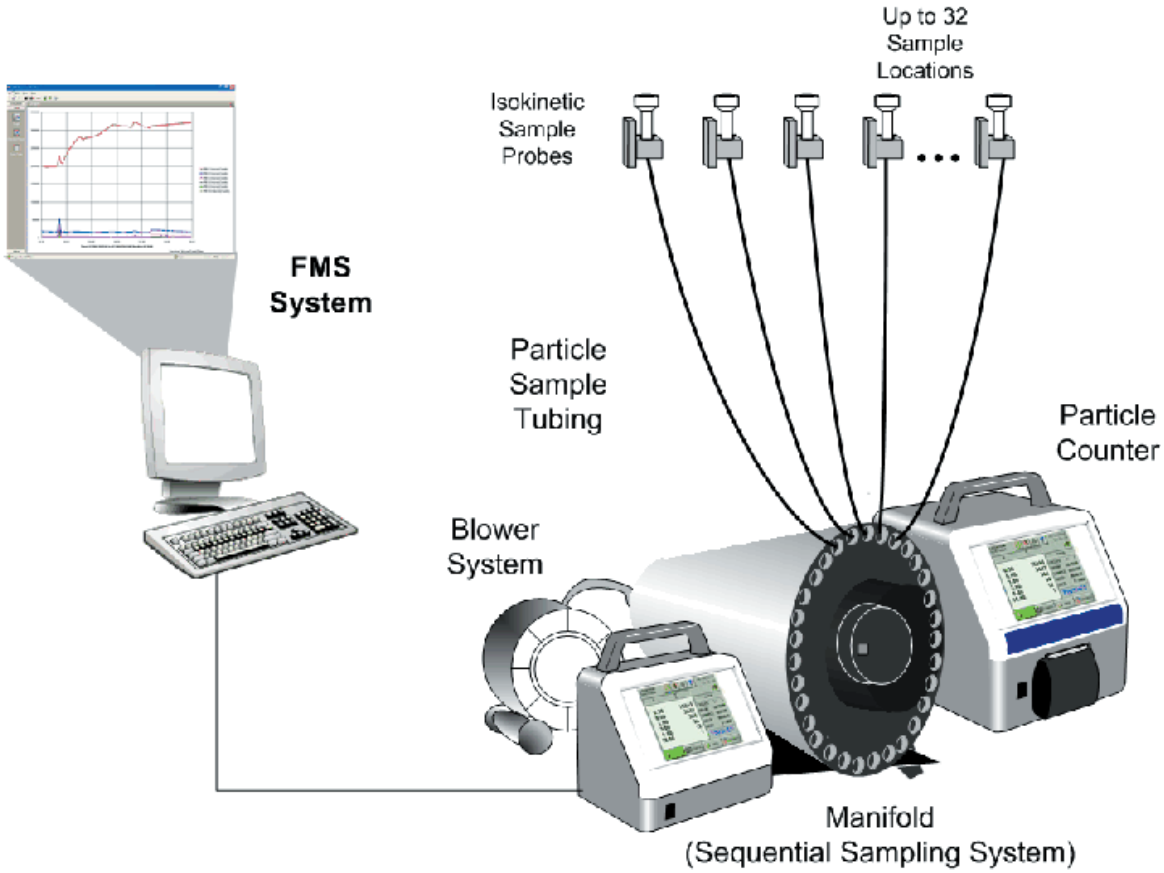


Figure 2

Sequential Particle Monitoring System



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