

Continuous Particle Monitoring

An Evaluation of Real-time Versus Sequential Sampling Particle Monitoring Systems

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

This 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.

- 1) Stand Alone Counter: Dedicated counter with Display and vacuum pump built in.
- 2) Remote Particle Counter: No display and is supplied vacuum for sampling via Process Vacuum or a separate pump for dedicated for 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 Pass/Fail 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 over, 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 a ten-second purge time to change to the next location. Based on this the following table can be used to determine sample frequency at a giving point.

| Number of Ports Samples | * Time between Samples at the same location | * Number of samples per day at same location |
|-------------------------|---|--|
| 10 Ports | 10 Minutes 40 Seconds | 135 Samples |
| 12 Ports | 13 Minutes | 110 Samples |
| 16 Ports | 17 Minutes 40 Seconds | 81 Samples |
| 24 Ports | 27 Minutes | 53 Samples |
| 32 Ports | 36 Minutes 20 Seconds | 39 Samples |
| 40 Ports | 45 Minutes 40 Seconds | 31 Samples |

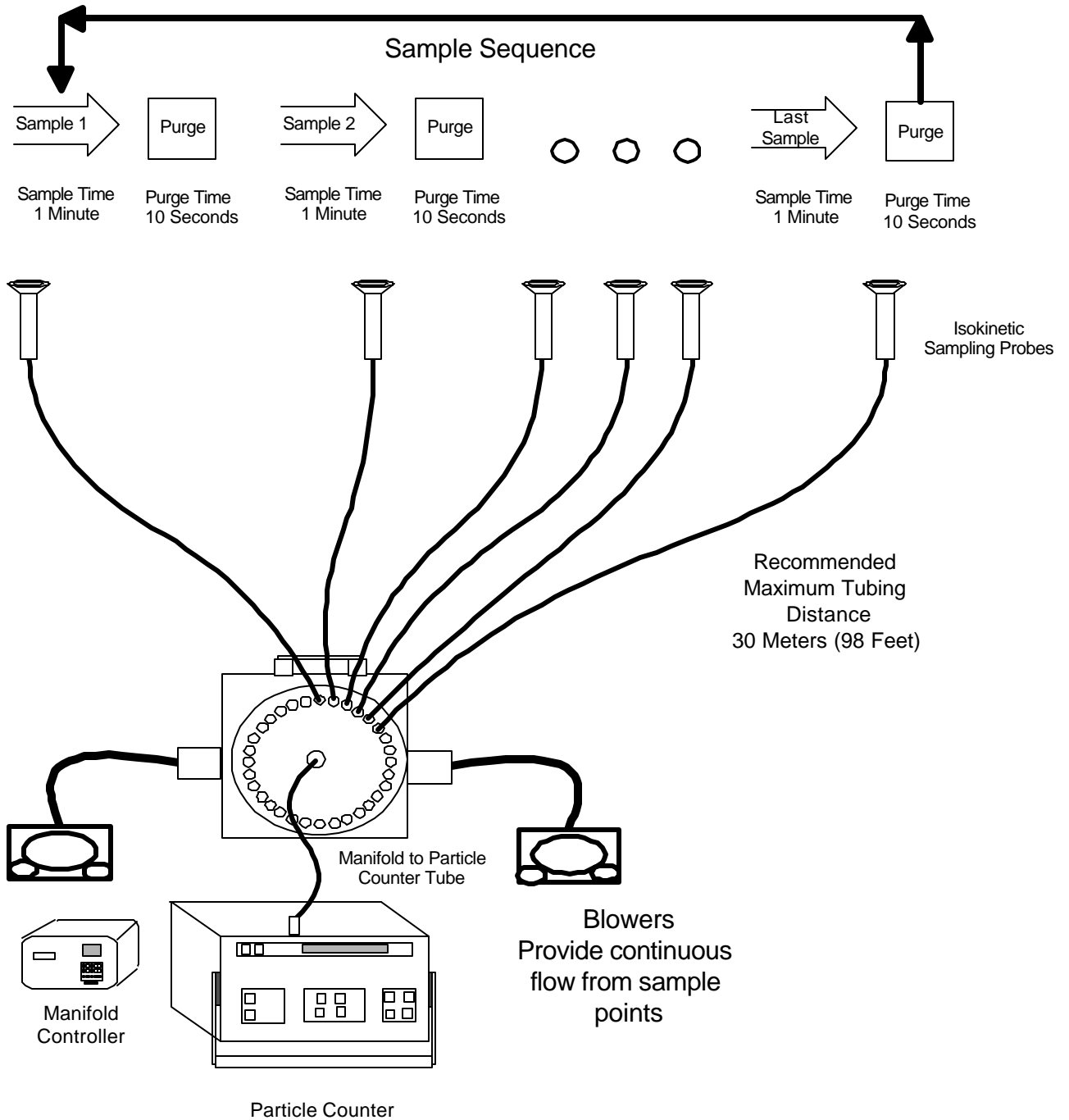
* Based on 1-minute sample, 10 second purge time

Manifold Particle Monitoring Advantages

- Allows for fewer counters to be used to cover a specific area
- Costs are decreased allowing greater sensitivity / cost
- Central location of the counter allows for easier service
- Reduced calibration costs
- Excellent for Cleanroom trending overall performance

Real Time Particle Monitoring 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 | Detects events only that occur over a longer duration, short events are missed and reported when sampled |
| Costs | For the same coverage more expensive due to individual counters are to be used. The lower the detection the greater costs | Lower for the same coverage. Can allow for lower detection limits (Smaller Particle Size) |
| Sample Interval | Continuous | See the above table |
| Installation | Sensors and sensing points can be located anywhere, tubing distance is not a factor | ~ 30 meters (98 feet) between the sample point and particle counter |
| Critical / Sensitive Location Monitoring | Detects everything, no gaps in data | Detects only trends and can miss single events |
| Calibration | More Sensors, more calibration | Fewer sensors, less calibration |
| Service | More Sensors greater needs for service | Fewer sensors, less service |



Sequential Particle Monitoring System

Real Time Particle Monitoring System

Real Time Particle Monitoring
Individual Sensors at Critical / Sensitive Locations
or Equipment

