UPW Monitoring Locations for the TSI Nano LPM™ System

Application Note CC-133 (US)

Introduction

The TSI Nano LPM™ System is designed for continuously monitoring ultrapure water (UPW) for nanoparticles down to 10 nm. The UPW sample continuously flows through the Nano LPM Particle Generator where it is atomized into an aerosol under conditions that allow the solid nanoparticles to be measured. Excluded from measurement are any particles smaller than 10 nm and non-volatile residue.

There are a variety of installed monitoring locations in semiconductor fabrication factories (fabs) that offer enhanced process control using the Nano LPM™ System. This document outlines these location benefits.

Benefits of UPW Monitoring

As chip geometries reduce in size to below 2 nm, detecting particles in the 10-100 nm size range has taken on increased importance for yield improvement. By controlling particles at the source, before they impact fabrication operations, the amount of post-processing defect mitigation is reduced-making upstream monitoring the preferred strategic approach to yield improvement.

Locations for UPW Monitoring

There are several leading choices for locations to consider.

- Final UPW quality at the fab supply header / UPW generation source — Supply location monitoring confirms that the expected quality of the UPW is achieved and can serve as a first warning of any increase in nanoparticle contamination. Unexpected events in the purification process may be detected. When analyzing the source of defects, assurance that the UPW is entering the fab at acceptable levels of contamination is essential.

- Return UPW quality leaving the fab process piping — Monitoring UPW at the end of the process piping can give an indication that something in the piping system somewhere in the fab may be causing elevated counts. Return monitoring is a 'worst-case' location that confirms that the expected quality of the UPW is achieved throughout the fab process piping leading up to the return monitor and can serve as an indication that a contamination issue may be present somewhere in the piping system. When coupled with supply monitoring, the location of the contamination may be isolated to the piping system, simplifying further analysis of the source of the defect.
- Lateral piping UPW quality to monitor portions of the piping system — Depending on the overall fab piping layout, specific phases or manufacturing lines may be monitored at the supply to those areas. If a specific process has more stringent requirements this is especially beneficial.
- Critical tool or process monitoring — Specific high-value tools or critical processes may be monitored at the UPW connection to the tool. This monitoring point could be post-POU filtration to assess final water quality just before product contact.

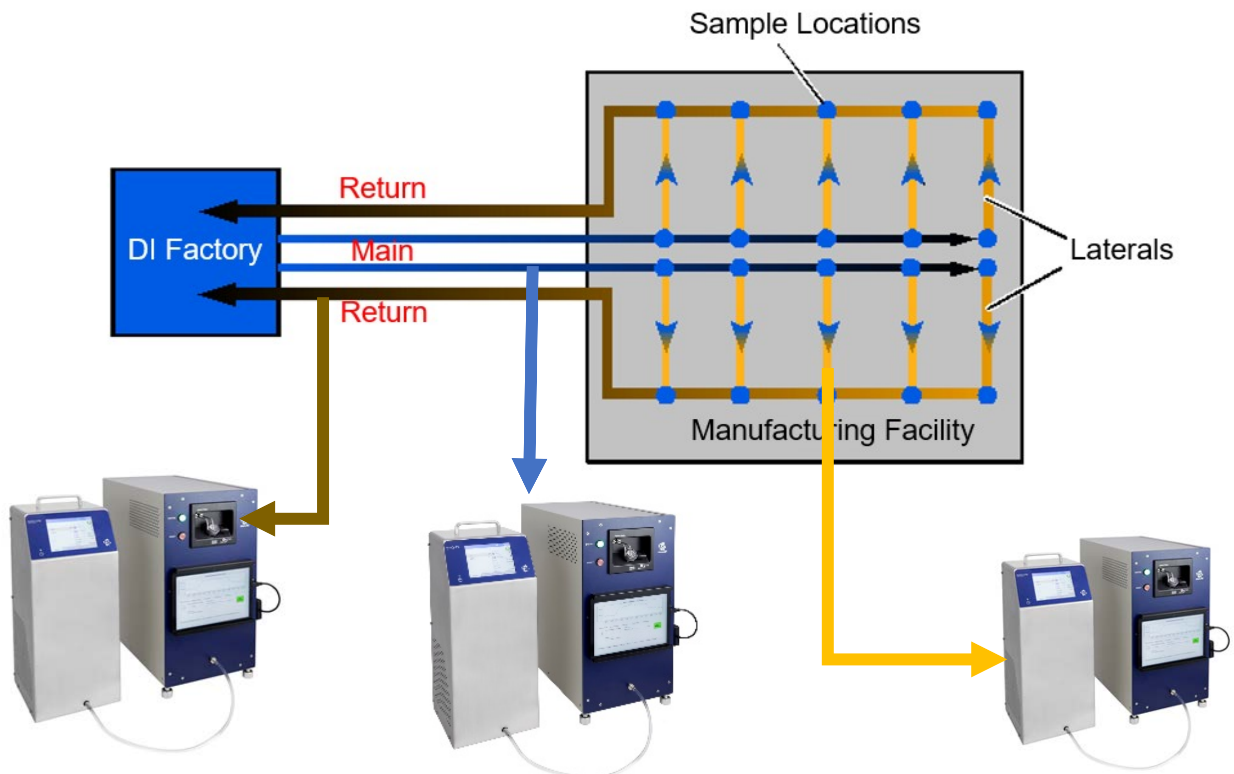

Figure 1: Schematic of UPW monitoring locations in fab using the TSI Nano LPM™ System.

Additional Applications for UPW Monitoring

- Filter efficiency testing — Actual measurement of solid particles in the 10-100 nm range allows robust measurement of UPW filtration effectiveness. Using standard nanoparticle of various materials, the UPW filter can be challenged upstream and measured downstream for filtration effectiveness to be determined/verified.
- Parts cleaning verification — Wetted piping or tool components that have been reprocessed or simply require nanoparticle analysis can be put inline upstream of the TSI Nano LPM™ System for analysis. The purity of the UPW ahead of the component under test should also be verified, to evaluate the contribution of the component to the overall particle level of the UPW.
- Troubleshooting / system contamination investigation — Temporary installation of the TSI Nano LPM™ System in any of the locations outlined in this document can be utilized to help pinpoint sources of possible contamination if it is present but not yet isolated to a source.

Conclusion

Detecting particulate contamination before it impacts product is the most valuable strategic yield enhancement approach in semiconductor manufacturing. The TSI Nano LPM™ System unveils the hidden realm of 10-50 nm solid particles in UPW — before they impact yield. Patented new technology offers robustness and material independent detection, using well established techniques applied in a transformative new approach. Monitoring in key locations throughout the semiconductor fabrication process drives cutting-edge defect reduction efforts. Get one today and start seeing your output climb.

Knowledge Beyond Measure.

TSI Incorporated – Visit our website **www.tsi.com** for more information.

USA	**Tel:** +1 800 680 1220	**India**	**Tel:** +91 80 67877200
UK	**Tel:** +44 149 4 459200	**China**	**Tel:** +86 10 8251 6588
France	**Tel:** +33 4 91 11 87 64	**Singapore**	**Tel:** +65 6595 6388
Germany	**Tel:** +49 241 523030		

CC-133 Rev A (10/28/2024) US ©2024 TSI Incorporated Printed in U.S.A

TSI and the TSI logo are registered trademarks of TSI Incorporated in the United States and may be protected under other country's trademark registrations.