APSRQ Wireless Particle Sensor for ASML, Nikon, & Canon Scanners

Maximizing yield and tool uptime in photolithography environments requires best-in-class practices for a contamination-free process environment. Unfortunately, identifying precisely when and where airborne particles originate is challenging with traditional methods.

Most sensor methods for photolithography environments fail to deliver real-time feedback, allowing "unexpected" particle sources to go undetected for significant amounts of time. As a result, these legacy solutions often cause long delays for results—generating costly downtime as the fab tool is torn down.

There are many advantages of using the ReticleSense Airborne Particle Sensor (APSRQ) to locate and troubleshoot airborne particles across photolithography environments.

APSRQ is widely used in photolithography applications.

Understanding the ReticleSense APSRQ

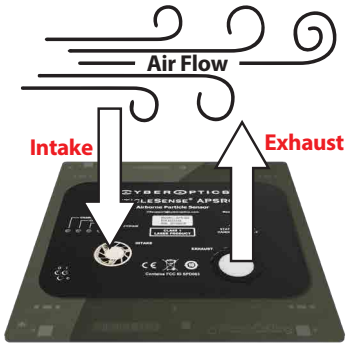
The ReticleSense APSRQ is an airborne particle sensor in the reticle format. This solution uses wireless particle sensing technology packaged in an actual reticle quartz housing for easy use inside of ASML, Nikon, and Canon scanners.

APSRQ travels through scanners (just like a quartz reticle) to detect particle sources exactly when and where they occur. This versatile technology is also ideal for use in FAB scanners and steppers that read barcodes and alignment in transmission.

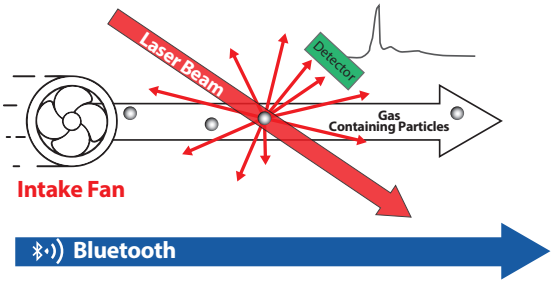
Innovative Wireless Particle Sensing Concept

Some partial pressure of air or inert gas carries particles to the airborne particle sensor with active airflow across the detector region. The APSRQ contains a laser-based particle detector—which uses light scattering to detect particles in a gas stream.

From here, the solution wirelessly communicates particle data in real time to a PC. The APSRQ travels like a reticle via tool automation and fab transport systems—and bins particles into two bins: 0.14µm and 0.5µm. Most importantly, the system records data for analysis and permanent maintenance records, ensuring appropriate follow-up.



Airborne Particle Sensor



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Drawbacks of Traditional Scanner Particle Detection Methods

There are three widely used methods for particle detection in photolithography environments:

- Monitor reticles
- Bench-top & hand-held airborne particle counters
- In-situ particle scanners

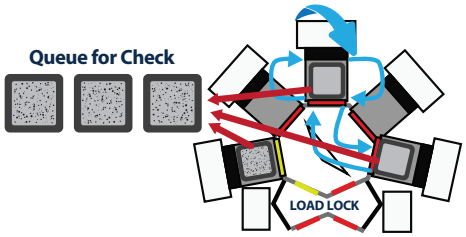
All three of these traditional methods have substantial drawbacks.

Particle Counting with Bench-Top & Handheld Methods

Bench-top counters require long hoses to reach into the tool—and are often incapable of following the reticle path. Similarly, bench-top and handheld methods make it difficult (and often impossible) to reach all locations of interest. In some cases, Equipment Engineers must crawl through the scanner equipment in order to make accurate measurements.

Particle Qualification with Monitor Reticles

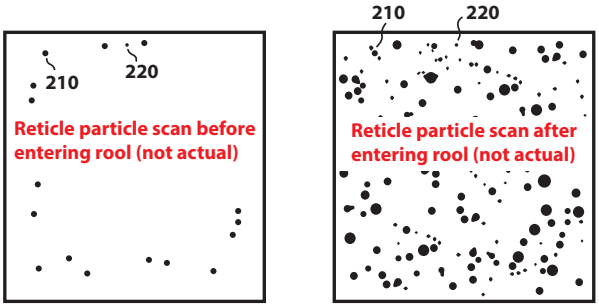
Monitor reticle scanning is time-consuming, creating long delays while waiting for test results. And surface scanning methods do not deliver results in real time, making it difficult to determine precisely when or where monitor wafers became contaminated.



Using Monitor Reticle or In-Situ Scanners

Photolithography tools scanned with monitor reticles and in-situ methods routinely have excessive particles. The in-situ scanner will scan monitor reticles going in clean—but intermittently exit with substantial amounts of particles of unknown origin.

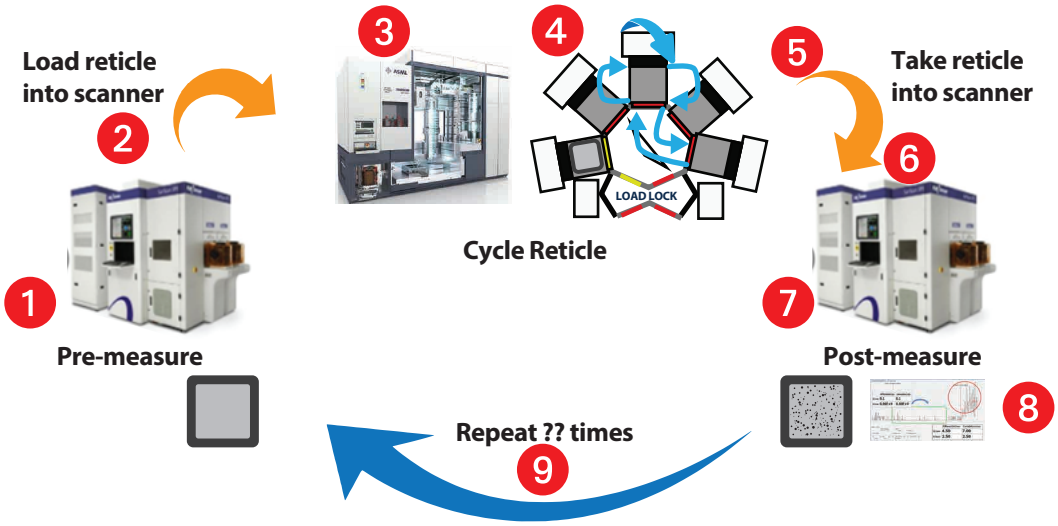
In summary, traditional methods for particle detection (build-in, monitor reticles, and bench-top particle counters) are unideal for identifying the particle source, making particle contamination a constant source of frustration for ASML, Nikon, and Canon scanner operations.



The Monitor Reticle Process - Process Until Problem Identified and Resolved

Particle Per Reticle Pass Test Procedure

1. Pre-measure test reticles
2. Stage test reticles
3. Load test reticles
4. Cycle test reticles
5. Take reticles out
6. Wait for post-measure inspection tool availability
7. Post-measure reticles
8. Analyze results
9. If problems found, repeat and/or partition areas of concern until problems are resolved



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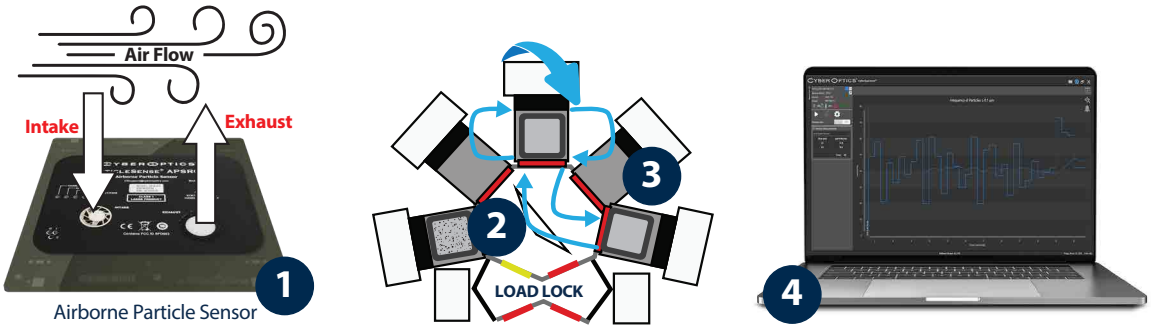
Using the APSRQ Particle Sensor is Quick & Easy

Here's a simple overview of the APSRQ solution—and how it drives speed and efficiency for particle qualification operations:

Step 1: Fan pulls air into sensor.
Step 2: Airstream passes detectors and particles counted using light scattering technology.
Step 3: Sensor travels like a reticle through the entire path of the reticle and to all process, handling, and storage locations.
Step 4: Particle data transmitted via Bluetooth in real-time to laptop application for display data stored in data file.

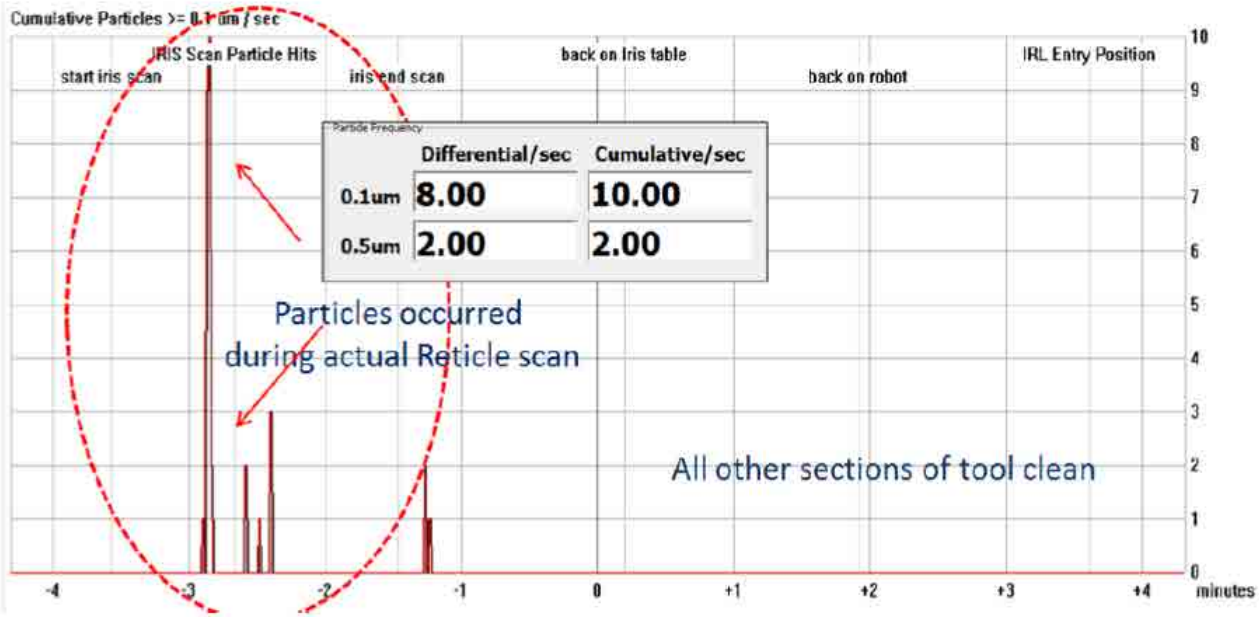


APSRQ Finds Particle Source in Minutes

Here's a rundown on how APSRQ technology finds the source of particles in scanning environments quickly and accurately:

Step 1: APSRQ is loaded into the tool. Most sections are found clean (zero particles).
Step 2: A particle spike occurs and is identified by the built-in particle scanner.
Step 3: Once the particle source is found, corrective action is taken for all associated moving parts.

Bonus ROI: With APSRQ, individual problem components can be replaced rather than entire kits.



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APSRQ Particle Sensor Results

The ReticleSense APSRQ is ideal for predictive and preventive maintenance for scanning equipment—as well as contamination control and process monitoring in atmospheric conditions. This solution enables more accurate and efficient particle qualification, resulting in maximum tool uptime.

Semiconductor fabs and OEMs worldwide value the accuracy, precision, and versatility of the ReticleSense APSRQ. This tool is the most efficient and effective wireless measurement device for airborne particles.

Save Time. Save Expense. Improve Yields.

APSRQ vs. Reticle Monitor Wafer Time Comparison - 10X Time Savings:
Monitor reticle scanning is time-consuming, creating long delays while waiting for test results. And surface scanning methods do not deliver results in real time, making it difficult to determine precisely when or where monitor wafers became contaminated.

Particle Investigation Process or Procedure	Monitor Reticle Time Estimated	APSRQ Time Estimate*	Comment
Pre-measure reticles	N/A	1 hour**	APSRQ ready immediately
Load test reticles	5 minutes	5 minutes	APSRQ handles just like a normal reticle
Cycle test reticles	10 minutes or until problem until problem found	10 minutes	No waiting for APSRQ results
Take reticles out	5 minutes	5 minutes	
Wait for post-measure reticle inspection tool availability	2 hours**	N/A results immediate	Once APSRQ uncovers problem area, troubleshooting begins instantly
Post-measure reticles	1 hour**	N/A	
Analyze results	2 hours**	N/A	APSRQ results immediate, thus analysis immediate
If problems found, repeat and/or partition areas of concern until problem identied and resolved	8-16 hours** Note: sometimes days until problem found with Reticle monitor	1-2 hours Note: trouble-shooting and resolution begins immediately	With APSRQ, once problem area found all possible particle sources investigated in real time, i.e, exercise moving parts. ep
Summary	12 to 20 hours**	1-3 hours** Note: 10X APSRQ times savings over monitor method typical	APSRQ also requires signicantly less resources such as manpower and insection tool resources not considered

**All times listed are estimates based on past user experience and used here for example purposes only.

To learn more about the CyberOptics ReticleSense APSRQ Wireless Particle Sensor and how it can support your scanning operations, contact us today . We'd be happy to address any questions you have.

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