

# 300mm Resist-Torr® XD Residual Gas Analyzer

High Sensitivity Photoresist Detection RGA



The 300mm Resist-Torr® XD incorporates V-lens™ technology advancing the proven performance of the 300mm Resist-Torr system to a new level of sensitivity, selectivity, and confidence in degas applications compared with conventional quadrupole mass spectrometry-based residual gas analyzers.

The patented V-lens design provides significantly improved detection power for the most challenging wafer degas applications where low ppb detection of contaminants and photoresist is required (<15ppb specified with Argon or Nitrogen).

With V-lens technology, the 300mm Resist-Torr XD overcomes the issues presented by challenging gases

such as Argon that the limited detection power of conventional systems cannot address. In combination with the unique PR Index from MKS, this powerful platform delivers a clear advantage for the monitoring and detection of trace gases. Process engineers are able to identify potentially costly wafer contamination earlier and maximize process yield.

The 300mm Resist-Torr XD consists of an optimum combination of V-lens technology, a closed ion source quadrupole mass analyzer and a fast response capillary inlet, together with advanced proprietary algorithms developed exclusively for the degas chambers on industry leading 300mm PVD cluster tools.

## Product Features

- V-lens technology provides:
  - Lower detection limits – up to 10 times improvement at lower masses (<15ppb)
  - Higher data quality – more reliable distinction between gases and background
  - Cleaner baseline – lower noise across the mass scale
  - 2x improvement in absolute sensitivity from improved focusing
- Detection of photoresist contamination during high pressure (~8 Torr) degas before wafers enter into 300mm PVD chambers
- Calculation of the PR Index – a measure of photoresist contamination level in the degas chamber



## Key Benefits

- Fully automated process monitoring means no operator necessary
- Variable alarm sensitivity to match product conditions in your fab or process tool
- Powerful optional data review feature to maximize ROI

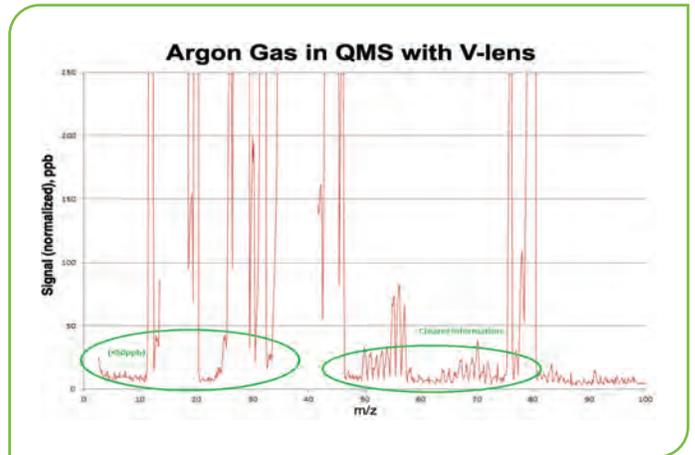
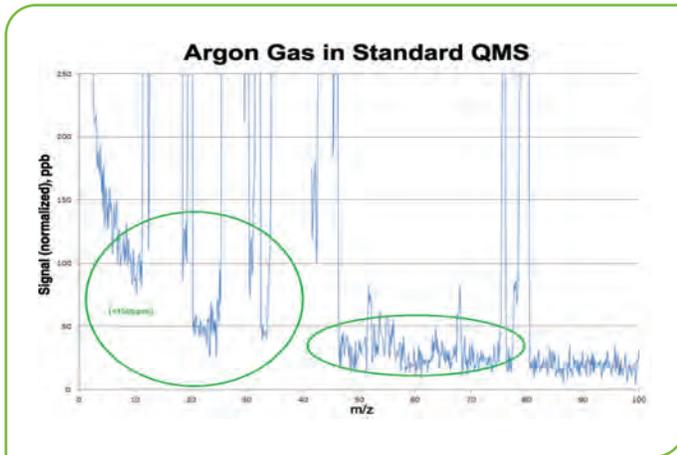


Figure 1 – Reduced baseline and improved sensitivity with V-lens technology - data acquired from purified Argon at atmospheric pressure, with and without V-lens technology.

### V-lens™ Technology

Degas processes typically employ inert gases such as Argon or Nitrogen. The use of these gases can be challenging as they generate an elevated baseline in RGAs due to large amounts of chemical background noise caused by metastable decay. This results in reduced sensitivity which can be problematic for manufacturers who want to identify changes in trace gases (which are indicative of issues during the manufacturing process) quickly and easily.

V-lens technology, a unique enabling solution, helps to overcome this issue by providing a consistently low mass-independent baseline (Figure 1) and detection levels in the low ppb range. This is achieved with unique ion optics that utilize a patented double-focusing and deflection mechanism that significantly reduces background and enhances sensitivity (Figure 2). The result is a gas analyzer with limits of detection in the low ppb range without compromise to any other aspect of instrument performance.

Figure 3 shows a real life example where degas monitoring of a signature mass could only be achieved when utilizing V-lens technology. The baseline is significantly reduced allowing for unequivocal identification of the target mass. This allows for faster and easier identification of trace gases which is critical in many manufacturing processes.

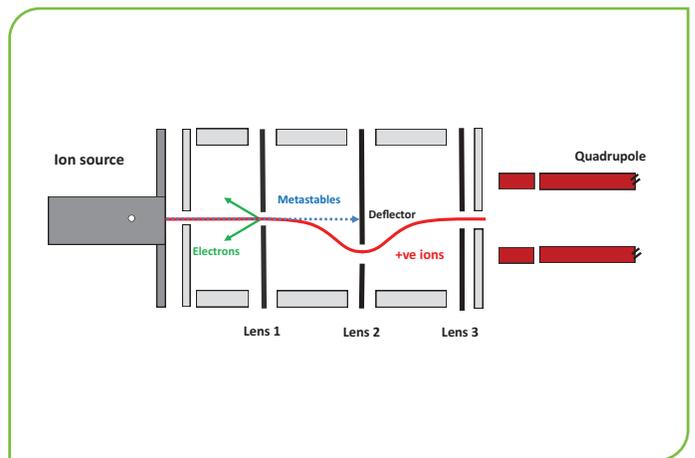


Figure 2 – V-lens Ion Optics Technology - Trajectories of negative ions (green), positive ions (red), neutral ions (blue) in the V-lens ion optics, reducing metastable decay.

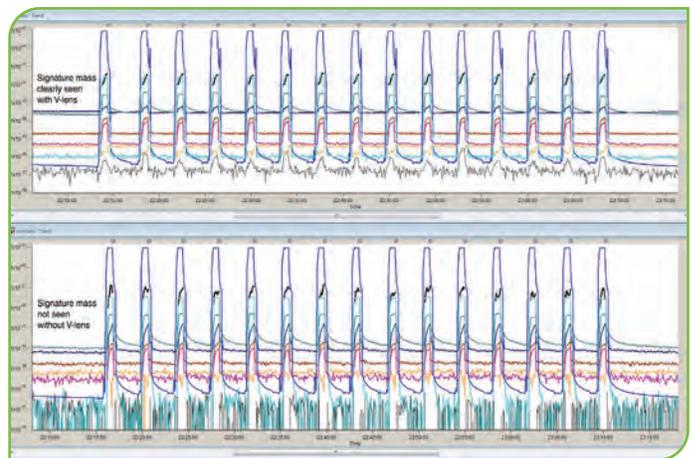


Figure 3 – V-lens technology – providing reduced baseline and increased sensitivity for the monitoring of a signature mass.

## PR Index and Fab Integration

When the system is utilized with the powerful features of the Process Eye™ and TOOLweb® RGA sensor control software package, the result is completely automated operation and highly reliable and sensitive photoresist detection. Unscheduled downtimes are reduced and device yields are improved.

The 300mm Resist-Torr XD considers many different parameters of the degas step and combines that data to provide information in the form of a meaningful number, without the need for user-interpretation. This measurement, termed the PR Index, is a normalized measure of wafer borne photoresist contamination that can be presented in various forms to compare data over time.

The 300mm Resist-Torr XD can interrupt the processing of any wafer automatically, without operator intervention, if a wafer enters the vacuum system with detrimental levels of residual photoresist, as determined by the PR Index. The example (Figure 4) shows a PR Index trace for a series of test wafers and provides the user a selective way to detect patterns that indicate contamination. The PR Index is shown as a black trend in the top line and the alarm level as a yellow line. The black PR line can be seen to elevate indicating that it has identified contaminated wafers. The PR Index allows a more sensitive and reliable method for detecting photoresist contamination.

## TOOLweb® RGA

Using TOOLweb RGA sensor integration option for process tools, the 300mm Resist-Torr XD can be used as a degas chamber sensor in a completely automated process environment (Figure 5). TOOLweb RGA maintains a constant monitor of tool activities with all sensor data being framed by wafer logistics before alarm models are applied. Full alarm and data reporting to the FAB host and FDC are available so real time monitoring of chamber conditions and flagging of any process excursions from ideal conditions is possible.

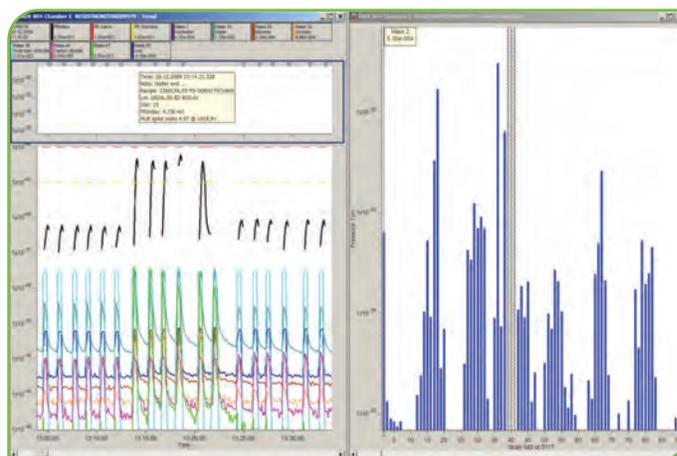


Figure 4 — PR Index for characterization of wafer contamination.

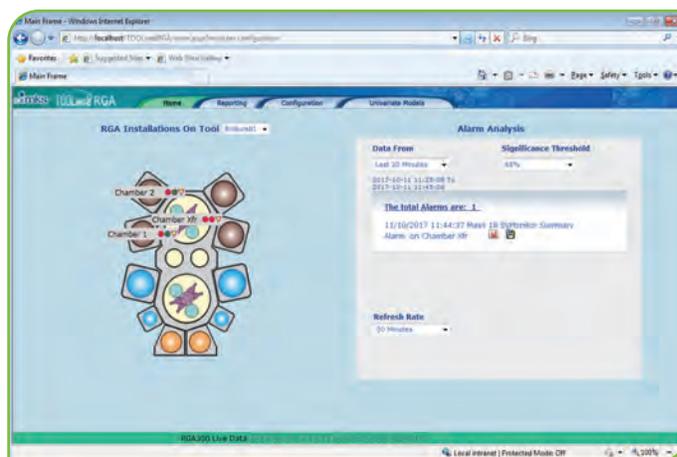
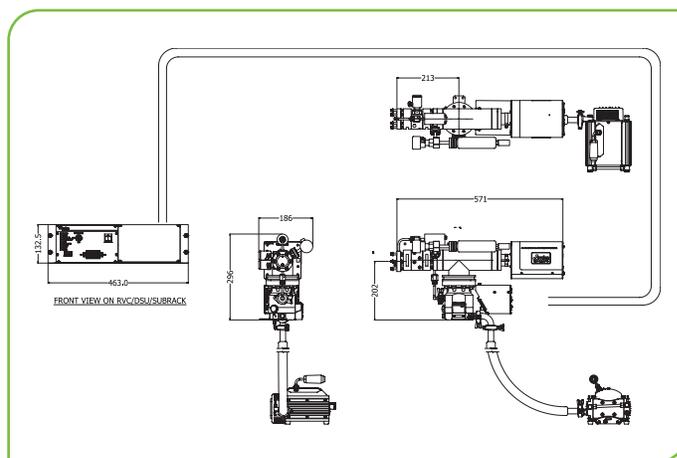


Figure 5 — TOOLweb RGA® home page screen for a tool with 300mm Resist-Torr® degas modules.



Dimensional Drawing — Unless otherwise specified, dimensions are nominal values in millimeters.

### Performance

<b>Mass Range</b>	1-200 amu
<b>Detector System</b>	Dual (Faraday and Secondary Electron Multiplier)
<b>Minimum Detectable Concentration</b>	<15ppb (specified with Argon or Nitrogen)
<b>Mass Stability</b>	Better than $\pm 0.1$ amu over 8 hours at stable ambient temperature
<b>Resolution</b>	Better than 10% valley between peaks of equal height throughout the mass range

### Analyzer and Housing

<b>Ion Source</b>	High sensitivity, closed ion source
<b>Filaments</b>	Replaceable twin Thoria filaments
<b>Analyzer Housing Base Pressure</b>	Better than $5 \times 10^{-9}$ Torr after bakeout
<b>Inlet</b>	Dual path with fast-response capillary for degas monitoring and high conductance for base vacuum. Includes heater jacket.
<b>Mass Filter</b>	Double filter (1" "RF only" pre-filter with 4" main filter)
<b>Mounting Flange</b>	2.75" Conflat® flange, SS capillary
<b>Bakeout Temperature and Bakeout Jacket</b>	Included for 180°C bakeout
<b>Vacuum Hardware</b>	60 l/s turbomolecular pump with high conductance analyzer housing, fast response capillary inlet system, automated vacuum controller (RVC) completely interlocked and integrated.
<b>Foreline Pump</b>	Dry diaphragm standard
<b>Calibration Hardware</b>	Reference gas standard for automated calibration

### Control Unit/PC

<b>Control Module Weight</b>	1.7 kg
<b>Power</b>	88-264 VAC, 47/63 Hz, 600 Watts
<b>Maximum Operating Conditions</b>	Electronics: 10-40°C, 80% RH (non-condensing)
<b>LED Status Indication</b>	Interlock status, filament emission, SEM, power and communications
<b>I/O Capability</b>	4 analog inputs and 2 outputs (plus 1 dedicated gauge input). Optional support for a large number of both analog and digital inputs and outputs, including relay control
<b>Other Facilities</b>	Leak check headset socket, external filament trip socket, instrument reset
<b>Software</b>	Process Eye Professional fully network compatible control platform generating 32bit or 64bit Microsoft® Windows® XP, Vista, Server 2008 or Windows 7* (*recommended)
<b>Communications</b>	Ethernet CAT-5e
<b>Minimum PC Specification Required</b>	Intel® Pentium IV® or AMD Athlon XP 1.2GHz, 1GB RAM, 120 GB hard drive, dependent upon total number of sensors on the computer and the operating system in use. Multi-sensor installation may require higher specifications. Simultaneous Multi-Sensor Process Eye Professional client/server configuration offers flexible multi-sensor operation.
<b>RGA Controller to Vacuum System Cables</b>	Length 33' (10 m) standard RGA. Other lengths available dependent upon process system and customer requirements
<b>Compliance</b>	CE

### Facilities

<b>Power</b>	88-264 VAC, 47/63 Hz, 600 Watts
<b>Pneumatics</b>	60-80 psig CDA
<b>Weight at Tool</b>	Approx. 24 lbs (11.0 Kg) to bolt-on process system (support stand or bracket required)
<b>Shipping Weight</b>	Approx. 85 lbs (38.5 Kg); can vary depending upon configuration

Please contact your local MKS office for price and availability information.