Vision 2000-P™ XD Residual Gas Analyzer

High Sensitivity Process Monitor for Select Pressure and PVD

The Vision 2000-P™ XD system is designed to monitor critical gas species at a selected pressure, from base vacuum up to 10 Torr. It is ideally suited to monitor vacuum integrity, contamination levels, or dynamics of specific process-related gases within semiconductor and thin film PVD process tools, and to alert operators about conditions that can negatively impact product yield. The Vision 2000-P XD also incorporates V-lens™ technology, taking the proven performance of the Vision 2000-P system to a new level of sensitivity and reliability, previously unachievable with conventional quadrupole mass spectrometry systems (QMS). The patented V-lens design enables significantly improved detection power for the most challenging thin film PVD processes where ppb detection of contaminants, gas leaks, or process gases is required. V-lens overcomes the issues faced with challenging gases (such as Argon) that limit the detection power of conventional systems, providing a clear advantage for monitoring and detection of trace gases. With V-lens technology, process engineers can identify and prevent potentially costly issues faster and easier while maximizing yield.

Product Features

- V-lens technology provides:
  - — Cleaner baseline – lower noise across the mass scale
  - — Lower detection limits – increased sensitivity up to 10 times improvement at lower masses (<15ppb)
  - — Higher data quality – more reliable distinction between gases and background
- Pressure selection (up to 10 Torr) and response time optimized with inlet valve and orifice options
- Process Eye™ Professional software for data acquisition, interpretation, recall, and intelligent alarming
- Application-specific RGA design for continuous in situ monitoring of processes taking place at a fixed pressure, typically within semiconductor and thin film PVD processes:
  - — Contamination monitoring, including hydrocarbons, to sub-ppm levels during PVD process
  - — Vacuum leak detection - residual gas monitoring, including air and water
- Baseline monitoring of PVD chambers for air leaks and background contamination levels
- Ability to track process gas mixture composition where two gases are utilized (i.e., Ar and N_2 in TiN deposition)

Key Benefits

- Vacuum troubleshooting for fast PM recovery
- Integration with a wide range of PVD and other semiconductor tools
- Remote Vacuum Controller (RVC) for fail-safe vacuum operation
- TOOLweb® RGA software for automated control and monitoring of semiconductor tools

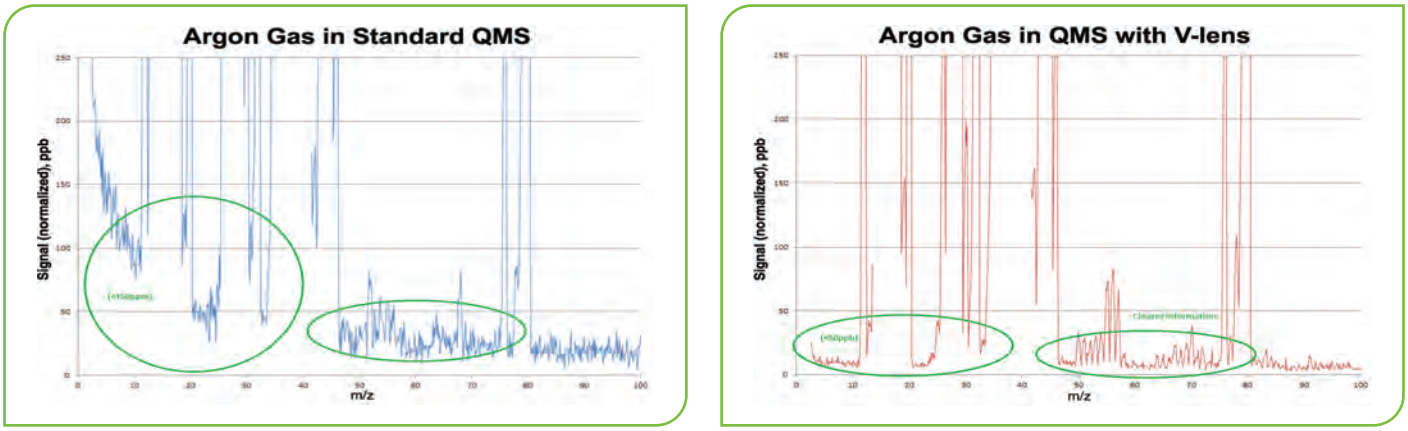


Figure 1 - Reduced baseline and improved sensitivity typically observed when using a QMS with V-lens technology - data acquired from purified Argon at atmospheric pressure, with and without V-lens technology[1].

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.

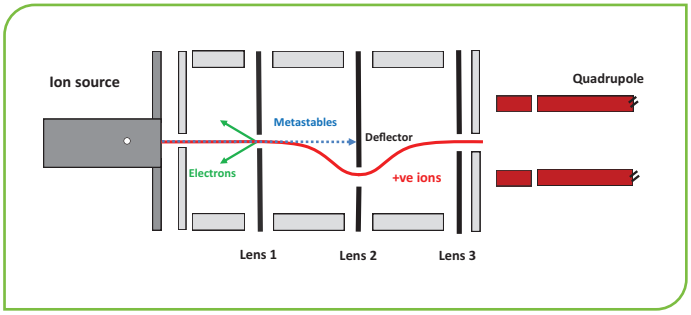


Figure 2 —
V-lens Ion Optics Technology - Trajectories of negative ions (green), positive ions (red), neutral ions (blue) in the V-lens ion optics, reducing metastable decay.

Closed Ion Source

The Vision 2000-P XD incorporates a closed ion source and a custom inlet valve with an optimized high conductance, low surface area path to the PVD process chamber. With this source, the system is able to monitor the complete PVD process cycle, from base vacuum to process pressures of up to 1e-2 mbar, without the need for a pressure reduction inlet. By maximizing the ratio between process gas signals and the gas background in the differentially pumped Vision 2000-P XD analyzer housing, the closed ion source in combination with V-lens enables low ppb levels of detection for trace contaminants in the process gas.

Remote Vacuum Controller

Each Vision 2000-P XD system incorporates a Remote Vacuum Controller (RVC) module that provides fail-safe protection for both the process tool and the RGA. Furthermore, it allows full operation and control of RGA system components (filaments, pumps, inlet valves, etc.) from the system PC.

Mobile RGA Platform

The Vision 2000-P XD can be mounted on a mobile RGA platform with the convenience of moving the RGA easily between chambers.

Process Eye™ Professional Control Platform

The Vision 2000-P XD analyzer uses Process Eye Professional. This highly flexible, modular application uses recipes to specify how the instrument scans, displays data, and responds to the acquired data. Recipes, user configurable using the “Recipe Wizard,” allow customized warnings and alarm levels, triggered whenever the process exceeds preset levels.

[1] *Enhanced Detection of Trace Gases with V-lens Ion Optics Technology; MKS Instruments, UK. S. Brereton, J. Blessing, J. Leslie and A. Wallace*

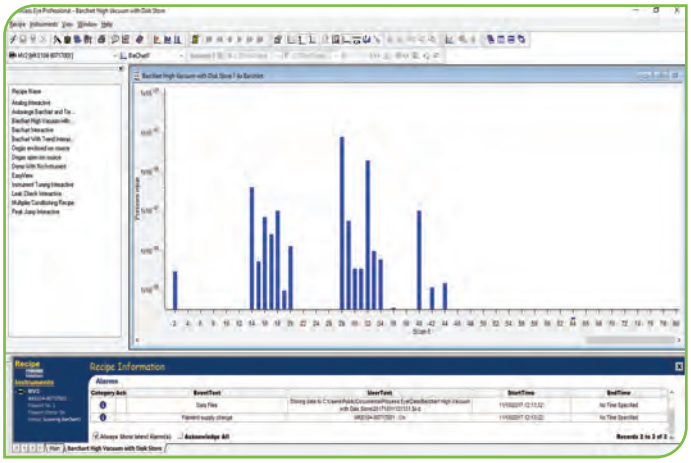


Figure 3 - Standard bar chart with log pressure axis.

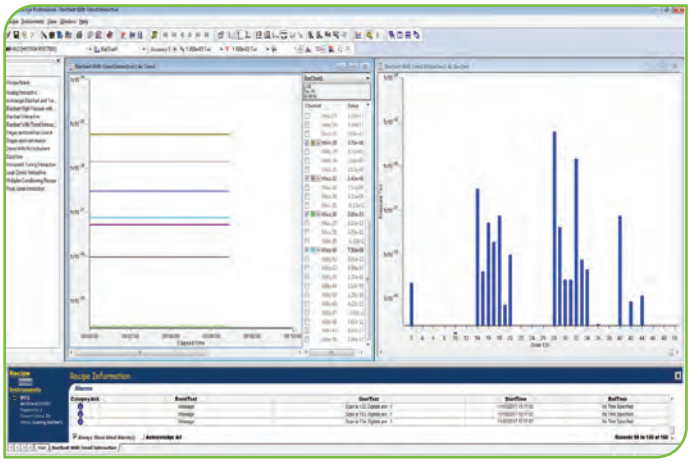


Figure 4 - Simultaneous log bar chart/trend analysis display, illustrating wide dynamic range scanning. Power supply potentials versus time is also shown.

Associated bar chart spectra and recently captured spectra are stored in a data buffer for easy review. Recipes can be linked together for the optimum monitoring of various phases of a particular process, or to facilitate automatic calibration using pre-defined calibration recipes. The single button push (or external signal) initiation of a Process Eye Professional recipe eliminates the need for highly skilled, full-time operators.

The flexibility of Process Eye Professional allows recipes to be configured that will:

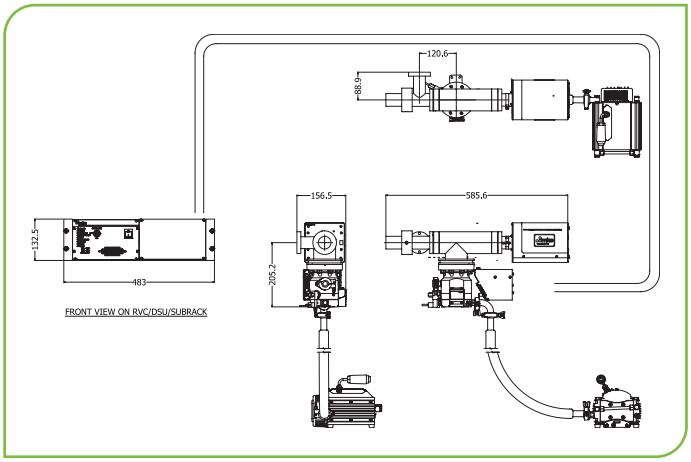
- Define data acquisition and data display parameters, along with any on-line data processing required to convert data into relevant units and information
- Display data in simultaneous “bar chart” (Figure 3) and “data trend” (Figure 4) formats, allowing the comprehensive and clear investigation of significant trend events
- Incorporate custom warnings and alarms, triggered or terminated when data highlights that process conditions have deviated from normal conditions
- Monitor and display other parameters as trends (temperature, gas flow rate, power, pressure, etc.)

In addition, Process Eye Professional provides “live history” for quick on-line review of data trend events. Recently captured bar chart spectra are stored in a data buffer and can be reviewed by moving a cursor over the associated trend plot.

TOOLweb® RGA

Using the TOOLweb RGA sensor integration option for process tools, the Vision 2000-P XD can be used as a degas chamber sensor in a completely automated process environment (Figure 5). TOOLweb RGA maintains a constant monitoring 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 allowing real-time monitoring of chamber conditions and flagging of any process excursions from ideal conditions.

Figure 5 - TOOLweb® RGA homepage screen for a tool with Vision 2000-P™ XD degas modules.



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

Specifications and Ordering Information

Performance	
Mass Range Options	1-100 amu standard; 1-200 and 1-300 amu optional
Ion Source	High conductance closed ion source
Filaments	Replaceable twin Tungsten or Thoria filaments
Mass Filter	Double filter (1" “RF only” pre-filter with 4" main filter)
Detector System	Dual (Faraday and secondary electron multiplier)
Maximum Analyzer Operating Pressure	7.6e-3 Torr (1e-2 mbar) at the ion source inlet (standard), higher pressure optional
Minimum Detectable Partial Pressure	<2e-11 Torr (for total pressures <1 x e-4 Torr on inlet)
Minimum Detectable Concentration (trace gas detection limit)	<15ppb (specified with Argon or Nitrogen for non-interfering peaks)
Mass Stability	Better than ±0.1 amu over 8 hours
Resolution	Better than 10% valley between peaks of equal height throughout the mass range
Analyzer and Housing	
Mounting Flange	DN35CF (70mm/2.75" OD) Conflat® flange
Vacuum Hardware	60 l/s turbomolecular pump with high conductance analyzer housing, inlet system, right angle valve, automated vacuum controller (RVC) completely interlocked and integrated.
Foreline Pump	Dry diaphragm standard; Other options available.
Analyzer Housing Base Pressure	Better than 5e-9 Torr after bakeout
Bakeout Temperature and Bakeout Jacket	Included for 180°C bakeout
Total Weight	33 lbs. (15 kg) to bolt on Process System
Mechanical Support	Optional stands and brackets are available.
Mobile RGA Platform	Optional RGA trolley to improve versatility (footprint 18x24", 455x604mm)
Pneumatics	60-80 psig CDA
Control Unit/PC	
Control Module Weight	1.7 kg
Power	88-264 VAC, 47/63 Hz, 600 Watts
Maximum Operating Conditions	Electronics: 10-40°C, 80% RH (non-condensing)
LED Status Indication	Interlock status, filament emission, SEM, power and communications
I/O Capability	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.
Other Facilities	Leak check headset socket, external filament trip socket, instrument reset
Software	Process Eye Professional fully network compatible control platform generating under 32bit or 64bit Microsoft® Windows® XP, Vista, Server 2008 or Windows 7* (*recommended)
Communications	Ethernet CAT-5e
Minimum PC Specification Required	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 process system and customer requirements.
Compliance	CE
RGA Controller to Vacuum System Cables	
Length	33' (10 m) standard RGA and 10' (3 m) with mobile RGA platform. Other lengths available dependent upon process system and customer requirements.
Total Shipping Weight	44 lbs (20 Kg); can vary depending upon configuration.

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

www.MKS.com

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