Vision 2000-C™ XD and Vision 2000-E™ XD Residual Gas Analyzers

High Sensitivity RGAs for Multi-Pressure and CVD/ALD

The Vision 2000-C™ XD and Vision 2000-E™ XD systems allow seamless monitoring of a wide range of semiconductor applications, including the complete ALD, CVD, and Etch processes, from base vacuum to process pressures up to 700 Torr. Both systems incorporate patented V-lens™ technology, taking the proven performance of the Vision 2000-C and Vision 2000-E systems to a new level of sensitivity and reliability, previously unachievable with conventional quadrupole mass spectrometry systems (QMS). The V-lens design provides increased sensitivity and reproducibility for the most challenging applications; such as tracking levels of various gas species during etch processes and the chamber clean, passivation sequences, and deposition steps for various ALD, CVD, and Etch processes. 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
- UniBloc™ fast-response inlet valve allows sampling at background and process pressures
- Process Eye™ Professional software for data acquisition, interpretation, recall, and intelligent alarming
- Application-specific RGA designed for continuous in situ monitoring of chemical vapor deposition (CVD) and etching processes
  - — In situ monitoring during chamber clean, passivation and deposition to detect subtle changes in low concentration species and high mass species decay with respect to time
  - — Ideal for qualification of new ALD, CVD or Etch process tools or process sequences
  - — Enables precision end-point characterization and process optimization
  - — Provides insight into etch rate variations
  - — Decreases time to production and time to ramp
- Baseline monitoring of ALD, CVD or Etch chambers for air leaks and background contamination levels

Key Benefits

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

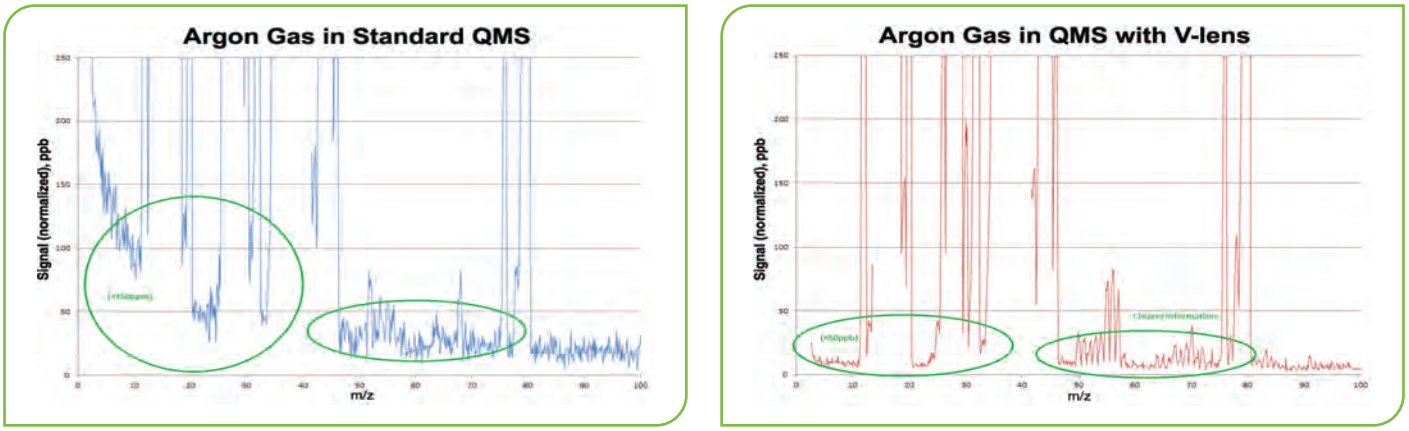


Figure 1 - Reduced baseline and improved sensitivity typically observed when using a QMS with V-lens technology - data acquired from purified Argon at atmospheric pressure, with and without V-lens technology.[1]

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.

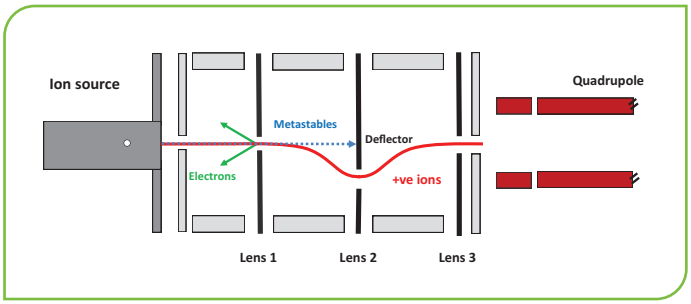


Figure 2 - V-lens Ion Optics Technology - Trajectories of negative ions (green), positive ions (red), neutral ions (blue) in the V-lens ion optics, reducing metastable decay.

This state-of-the-art RGA technology is integrated with Process Eye Professional control platform, a recipe based, user-configurable software program. The combination of V-lens, a closed ion source, and automated inlet allows for sensitive and reproducible monitoring of the complete ALD, CVD, or Etch process cycle.

By maximizing the ratio between ALD, CVD, or Etch chamber gas signals and the gas background in the differentially pumped analyzer housing, the V-lens and closed ion source enables low ppm-level detection for trace contaminants in the process gas.

Closed Ion Source

The closed ion source analyzer is manufactured from vacuum prepared stainless steel and high density alumina ceramics, and features independently replaceable twin filaments to provide built-in backup in the event of a filament failure. The standard system includes a double filter analyzer for increased sensitivity of higher mass species, contamination resistance and enhanced long-term stability.

Remote Vacuum Controller

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

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

UniBloc™ Inlet Valve

The fast-response UniBloc inlet valve (Figure 3) allows sampling at both background and process pressure. When not sampling, both the valve and analyzer are automatically isolated from the process chamber and purged with inert gas. Purging is via the mass spectrometer pumping system, not through the process chamber. Purging is also used during bakeout, reducing initial startup time and residual background recovery time. For sampling up to 10 Torr, a special 4-valve UniBloc is available for bypass pumping to facilitate the faster transfer of sample gas to the inlet, thereby optimizing inlet response time. Above 10 Torr, the 4-valve configuration is always used. The inlet valve is operated by integrated electronics and controlled via recipes from Process Eye Professional. The required valve selection is made automatically by a gas independent pressure sensor in the UniBloc inlet that also provides a read out of the process chamber total pressure. The internal seals are Kel-F® for compatibility with ALD, CVD, and Etch process gases. The external seals are all metal.

Figure 3 - UniBloc™ Inlet Valve.

Mobile RGA Platform

All Vision 2000-C XD or Vision 2000-E XD systems can be mounted on a mobile RGA platform with the convenience of moving the RGA easily between chambers.

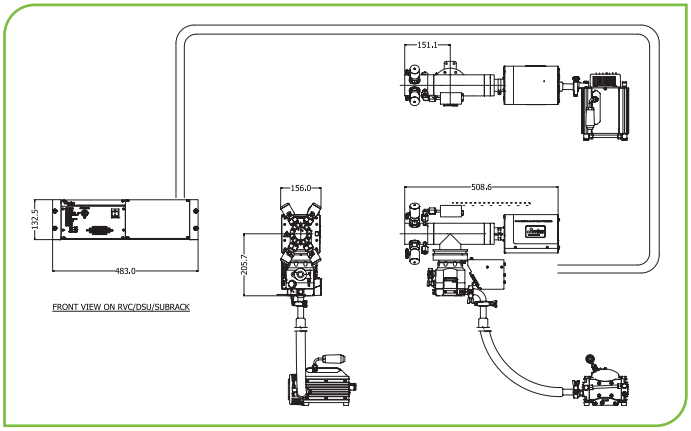
Process Eye™ Professional Control Platform

The Vision 2000-C XD and Vision 2000-E XD analyzers use 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. Other key parameters can also be set via the recipe. This allows optimization for each stage of the process. Process Eye Professional provides:

- Automated and intelligent operation of MKS RGAs
- Recipes for automated calibration
- Flexible scanning — "Bar Chart", "Analog", and "Peak Jump" modes can be associated with data trend displays
- Intelligent, user defined warnings and alarms include a suggested diagnosis of the fault condition and a recommendation for its solution
- Optional ability to read data from other sensors using analog inputs and external events by digital inputs
- Data buffer for quick on-line review of recent data
- Full storage of all data for review and analysis

TOOLweb® RGA

Using the TOOLweb RGA sensor integration option for process tools, the Vision 2000-C XD and Vision 2000-E XD can be used as a degas chamber sensor in a completely automated process environment (Figure 4). 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.



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

Figure 4 - TOOLweb® RGA homepage screen for a tool with Vision 2000 XD degas modules

Analyzer	
Mass Range Options	1-300 amu
Ion Source	High conductance closed ion source
Filaments	Replaceable twin Tungsten 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	1e-3 Torr at the ion source inlet (standard), higher pressure optional
Minimum Detectable Partial Pressure	<2e-11 Torr (for total pressures <1e-4 Torr on inlet)
Minimum Detectable Concentration	<15 ppb (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
Vacuum System Pressure Ranges	
Base Pressure Ranges	Ion source at maximum pressure at 1 mTorr or 100 mTorr
Process Pressure Ranges	Ion source at maximum pressure at 10 mTorr, 500 mTorr, 1.5 Torr, 5 Torr, 10 Torr, 40 Torr, 100 Torr or 700 Torr (*Optional gas acceleration for ranges <10 Torr available. For other inlet and process pressure ranges, please consult the factory).
Mounting Flange	DN35CF (70mm/2.75" OD) Conflat® flange. Custom adapters can be provided.
Vacuum Hardware	60 l/s turbomolecular pump with high conductance analyzer housing, inlet system, UniBloc inlet, automated vacuum control (RVC) completely interlocked and integrated.
Standard Backing Vacuum System	Connected to the tool foreline pump via surge protect assembly with KF16 fitting.
Optional Backing Vacuum System	Independent chemically resistant, dry diaphragm pump with KF16 fitting for connecting the exhaust to a suitable scrubber system.
Base Pressure	Better than 5e-9 Torr after bakeout
Bakeout Temperature and Bakeout Jacket	Included for 180°C bakeout
Operating Temperature	90°C (controlled to ±1°C)
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' (3m) 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.

www.MKS.com

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