



An Integrated Component Subsystem™ that incorporates vaporization and pressure-based mass flow control in a single unit.

Flow

Measurement & Control

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VoDM-C

VAPOR ON DEMAND MODULE

A need has been demonstrated for the reliable delivery of water vapor into photoresist strip and post metal etch passivation processes. This has previously been done using a heated vessel of water that produces the vapor and a flow controller to deliver the vapor to the process. Attempts have been made to control this vapor flow with needle valves, thermal mass flow controllers and choked flow technology. These schemes work until the heated reservoir must be refilled. The addition of liquid water to the reservoir causes a drop in its temperature, a concurrent drop in its vapor pressure, and loss of driving force for the vapor into the process.

MKS Instruments has developed a single unit, the Vapor on Demand Module, that uses a continuous flow of liquid, eliminating the problems associated with refilling the source vessel. The Vapor on Demand Module, or VoDM, consists of a vaporizer section and a vapor controller section. Liquid is fed directly from the house DI water supply into the vaporizer. The vapor produced is then fed to the mass flow controller which is based on the MKS 1153 Vapor Phase Mass Flow Controller. The control circuits for the various control elements, liquid, vapor and power, are internally controlled by an onboard microprocessor to provide smooth and responsive delivery of water vapor to the process. Communications with the tool are through an analog I/O where flow rate set point and valve overrides are input, and the flow rate of delivered vapor and downstream pressure are reported.

Features & Benefits

Proven

- Based on existing flow technology
- Based on Baratron® Capacitance Manometer technology

Robust

- Corrosion resistant materials resist attack by Hot Deionized Water
- Field proven software controls liquid, vapor and power

Compact

- Vaporization and vapor mass flow control in one unit
- Requires only water supply, vapor outlet, AC power, and DC signals



Description

The VoDM consists of a Vapor Phase Mass Flow Controller, based on the MKS Type 1153, mated to the outlet of a compact flash vaporizer. The flow of liquid is controlled by the pressure inside the vaporizer, so that a small reservoir of hot vapor is available for immediate use when called for. The 1153 is a choked flow device with an onboard microprocessor that continuously monitors the absolute pressure upstream of the flow control nozzle as well as the differential pressure and pressure ratio across the nozzle. As a result, it continuously determines the flow regime and calculates the flow rate based on the appropriate flow model. Thus, it is able to accurately report the flow rate no matter what the pressure conditions. The microprocessor also functions to control the power to the heaters for both the vaporizer and flow controller body, and controls the flow rate of liquid into the vaporizer. In addition, the VoDM is supplied with a transformer based power supply for the heaters, mounted on top of the flow controller, that requires 110/220VAC.

Materials of Construction

For a number of years, water vapor has been delivered to processes using the heated ampoule and heated pressure or thermal based flow controller approach. The materials of construction of the flow controllers in these instances have been compatible with water vapor. However, deionized water, especially when heated to its normal boiling point or higher, can be extremely aggressive, causing staining and pitting corrosion in very short periods of time.

Because of this extremely aggressive behavior of hot DI water, MKS has gone to extreme lengths to specify the appropriate materials to minimize this effect. The result of this work is a vaporizer that is conspicuously free of corrosion.

Performance

The VoDM is designed to respond very quickly to changes in set point. The standard MFC settling time of within 2% of set point within 2 seconds holds with this unit in accordance with specification SEMI E17-91. A small volume of vapor is held in the vaporizer to supply the controller until the heaters and water valve are operational. Only the vapor control valve needs to close to shut off the vapor flow; no liquid is held downstream of the control valve.

The accuracy of the VoDM, specified as 3% of Full Scale (F.S.), along with a repeatability of 0.2% of F.S., is a function of the accuracy of the vapor controller. Over the course of time, we have shown that the Type 1153, because of how it is calibrated, has a typical accuracy of better than 1% of F.S. Thus the VoDM also has a typical accuracy of better than 1% of F.S.

Compatible Products

The VoDM has been designed as an OEM product, for use on systems with central process controllers. These process controllers would normally have the capability to output the appropriate power and commands and read the signals generated by the VoDM.

For those systems where a central process controller is not available, certain MKS Power Supply/Displays are capable of some of these functions. MKS Models 247D and 647B Power Supply/Displays with appropriate cabling are compatible with the VoDM for powering the MFC portion, supplying the set point and reading the flow output and downstream pressure. They do not, however, have available the TTL level commands or outputs used by the VoDM.



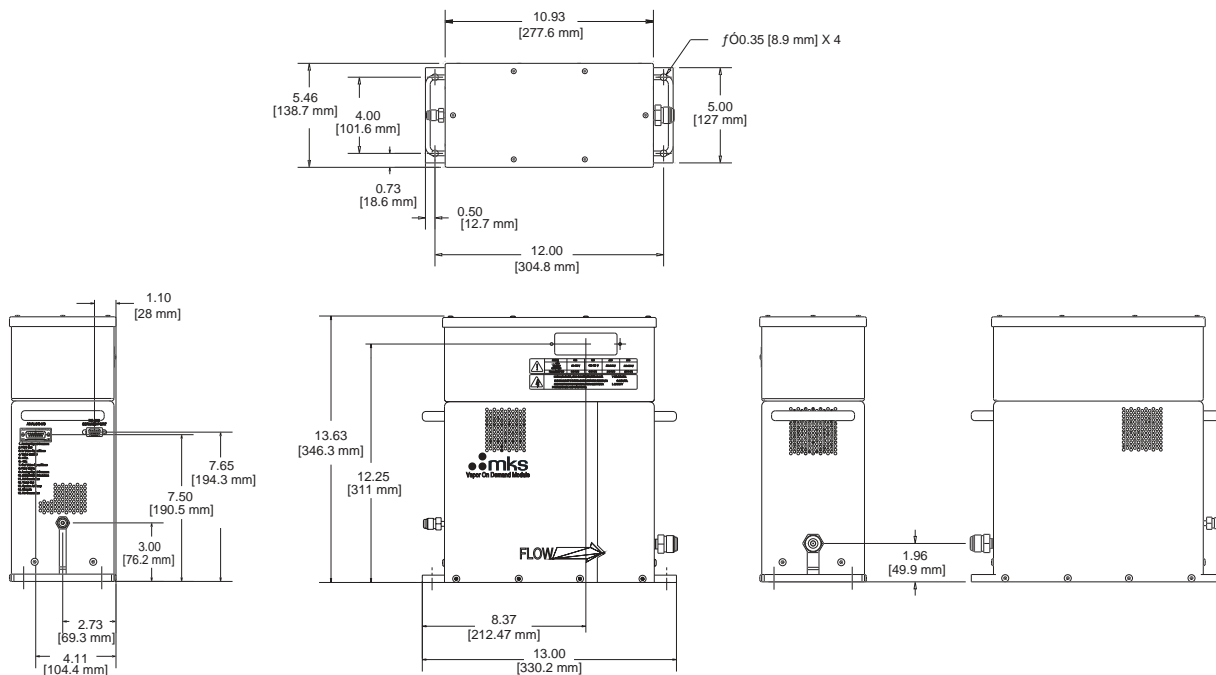
Specifications

| | |
|---|--|
| Full Scale Range | 500, 1000, 3000 sccm Water Vapor |
| Control Range | 10-100% F.S. |
| Accuracy | 3% of F.S. |
| Repeatability | 0.2% of F.S. |
| Resolution | 0.1% of F.S. |
| Operating Temperature (Internal) | 125°-140°C |
| Ambient Temperature Range | 15°-45°C |
| Settling Time | 2 seconds within 2% of set point, per SEMI E17-91 |
| Input Power | 3.5 Amps @110 VAC Note- The IEC AC input module will accept 90-105, 100-130, 200-240 or 210-250 VAC, 1Ø power |
| Water Supply Pressure | 20-40 psig |
| Leak Integrity | |
| To atmosphere | <1x10 ⁻⁹ scc/sec He |
| Internal Across Valve | <1x10 ⁻³ scc/sec He |
| Input Signals | Flow Set Point; 0-5 VDC Valve Overrides, TTL level Auto Balance, TTL level |
| Output Signals | Flow Output, 0-5 VDC At Temperature, TTL level |
| Electrical Connectors | DC Signals, 15 pin Type "D" RFI/EMI Shielded AC Power, IEC fused Input Module |
| Process Connections | Inlet, 4 VCR® male Outlet, 8 VCR® male |
| Mounting Orientation | Horizontal on base, Vertical flow up |
| Weight | 31 lbs. |



Ordering Information

| Ordering Code Example: VODMC13CR1BE | Code | Configuration |
|--|-------|---------------|
| Vapor on Demand Module (VoDM) | VODMC | VODMC |
| Flow Range Full Scale (sccm of Water Vapor) | | |
| 500 sccm Water Vapor | 52C | 13C |
| 1000 sccm Water Vapor | 13C | |
| 3000 sccm Water Vapor | 33C | |
| Fittings | | |
| 4VCR Male Inlet, 8 VCR Male Outlet | R | R |
| Power Supply Orientation | | |
| Right Hand Outlet | 1 | 1 |
| Left Hand Outlet | 2 | |
| Connector | | |
| 15-pin Type "D" Electrical Connector | B | B |
| Seal Materials | | |
| Perfluorelastomers | E | E |



Dimensional Drawing —

Note: Unless otherwise specified, dimensions are nominal values in inches (mm referenced).



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