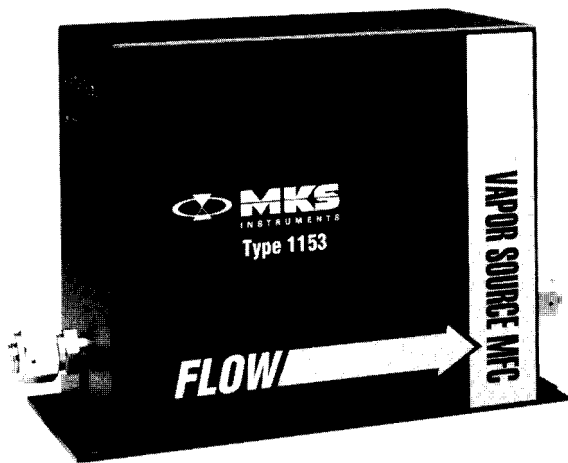


Type 1153 Mass-Flo® Controller

A pressure-based measurement and control system to meter and control vapor from low vapor pressure liquid and solid sources



Features & Benefits

- Delivers low vapor pressure liquids and solids without the need for a carrier gas system, for precise, repeatable vapor source delivery
- High operating temperature up to 200°C
- On-board CPU allows for control of flow over a wide range
- Control of flow via analog (0-5 VDC) or RS-232 offers flexibility and diagnostic capabilities
- All metal internal CF-style seal design eliminates contamination due to permeation of elastomeric seals
- Maximum flow (process dependant): 10 slm with 760 Torr inlet to a 10 Torr process allows for high throughput

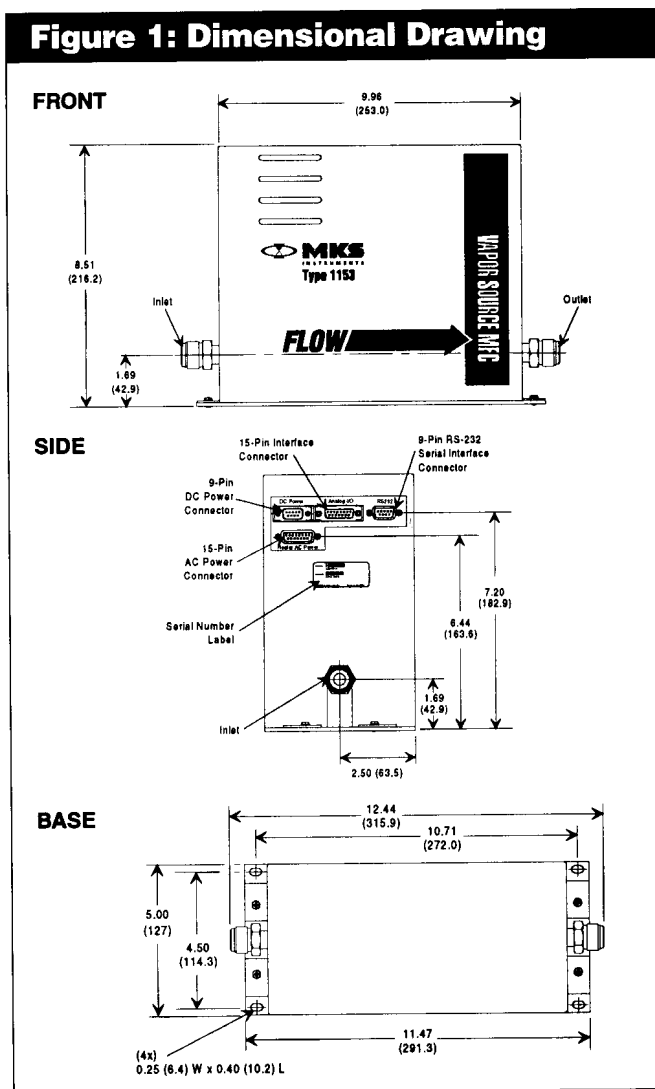
Introduction

A need exists in thin film processes to deliver solid precursors to CVD reactors in a precisely controlled manner. Currently, the only commercially available method to deliver solids is using solvent/solute chemistries with liquid delivery methods (i.e. liquid flow meters or direct liquid injection). A limitation of liquid delivery methods is that some solid precursors have solubility limits which restrict the maximum precursor mass flow that can be delivered to the process chamber.

MKS has developed the Type 1153 to deliver controlled amounts of vapor from a solid source or low vapor pressure liquid source precursor to the process chamber at rates consistent with high throughput requirements.

Description

The MKS Type 1153 Low Vapor Pressure Source Mass-Flo Controller is a pressure-based measurement and control system designed to meter and control vapor from low vapor pressure liquid and solid sources directly, without the need for a carrier gas. The flow of vapor is controlled via pressure-based techniques using two Baratron® pressure transducers, a flow orifice, and a high temperature solenoid valve. Tight temperature control is possible using a thermally optimized heater block design.



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

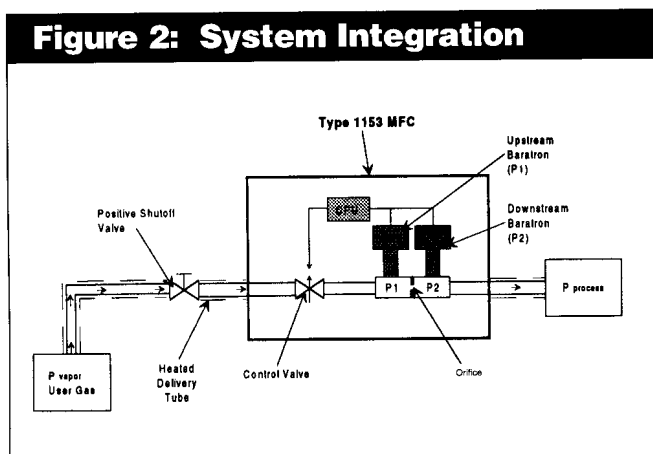


Figure 2 shows a typical system set up using the Type 1153.

Materials

The Type 1153 is used for CVD thin film applications in the semiconductor, industrial coating, and flat panel display industries to deliver low vapor pressure precursors. For example, the Type 1153 is being used for the delivery of solid titanium precursors for the deposition of barriers. The delivery of polymer compounds is also being evaluated for the deposition of low k dielectrics. In addition, the delivery of tetramethyl heptandionate (TMHD) compounds for the deposition of high k dielectrics and ferroelectrics is being investigated.

System Integration

In application, the Type 1153 is placed downstream of the heated source ampule (Figure 2). Delivery lines from the source ampule to the process chamber should be as short as possible and heated. A positive temperature gradient should be maintained on components and the plumbing from the source ampule to the process chamber to prevent condensation. The Type 1153 may be placed in a heated source oven with ambient temperatures up to 45°C. MKS has developed a computer model to aid in the configuration of a Type 1153 Low Vapor Source Flow Controller to best suit a particular material, flow rate, and system pressure. Given the necessary information, a computer-generated plot of flow versus voltage is easily obtained.

System Components

Pressure measurements in the Type 1153 are made by reliable MKS Baratron® capacitance manometers. Components are assembled to the flow element body using CF seals. The environment around the mechanical assembly of control valve, flow element, and sensor is controlled up to 200°C using safe 24 VAC cartridge heaters and an aluminum heater block design. Contained on-board is a CPU (Central Processor Unit) which processes input signals and controls temperature and flow output signals. Using a digital control loop, the valve driver output is sent to a high temperature solenoid control valve upstream of the flow element to deliver the desired amount of gas flow to the process chamber.

Specifications

Full Scale Range	Full Scale range is dependent on process conditions; Consult Applications Engineering at 800-227-8766 (e.g., if delivering N ₂ at an inlet pressure of 8 Torr and a process pressure of 2 Torr, F.S. ranges of 10 sccm to 250 sccm are available)
Control Range	10% - 100% of F.S.
Accuracy	± 3% of F.S.
Repeatability	± 0.2% of F.S.
Measurement Resolution	± 0.1% of F.S.
Operating Temperature Range	30° to 200°C (Ambient temperature 15°C to 45°C)
Settling Time	2 seconds to within ± 2% of set point
Input Power Required	
Heaters	24 VAC at 8 Amps
Analog control	± 15 VDC ± 5% at 1 Amp
Flow Set Point Signal	0-5 VDC from < 20K Ω source
Temperature Set Point Signal	0-5 VDC from < 20K Ω source
Flow Output Signal	0-5 VDC from > 10K Ω load
Temperature Output Signal	0-5 VDC from > 10K Ω load
Connector Type	
DC Power	9-pin Type "D", RFI/EMI shielded, male
I/O	15-pin Type "D", RFI/EMI shielded, female
Heaters	15-pin Type "D", RFI/EMI shielded, male
RS-232	9-pin, digital, female
Maximum Line Pressure	35 psia (higher for 5000 Torr range sensors and up)
Leak Integrity	
To atmosphere	< 1 x 10 ⁻⁹ scc/sec He
Through closed valve	< 3% of F.S. at process conditions
Process Wetted Materials	316 L S.S., Inconel®, and nickel
Fittings	Swagelok® 8 VCR® male
Software	
RS-232 Operational Functions	Flow Temperature Valve OPEN/CLOSE/CONTROL Gas Calibration Factors (ratio of specific heats, molecular weight, calibration constants)
Attitude Sensitivity	Do not mount unit upside-down

Specifications are subject to change without notice.
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