



DELTA™ II DeviceNet™

DLT2A2 - FLOW RATIO CONTROLLER

PROCESS OPTIMIZATION THROUGH PRECISE FLOW RATIO CONTROL

The DELTA II Flow Ratio Controller is a critical process control instrument in the MKS line of digital control, web-enabled products providing the latest in gas flow ratio measurement and control technology necessary to meet the demands of multi-channel flow distribution.

The DELTA II mass flow ratio controller divides and controls mixed process gas flows to either multiple chambers or zones within a process chamber at ratios specified by the user to maximize process uniformity and repeatability. The DELTA II flow ratio controller with its improved performance and more compact design is the second generation of MKS industry leading DELTA controllers enabling process gas flow ratio control.

Widely used in a variety of flow splitting applications such as etch, strip, and CVD, the DELTA II provides the user with the ability to distribute gas or gas mixtures to two different zones in a process chamber. Send the DELTA II a gas – or any mixture – and a ratio set point and the DELTA II will split the gas into two separate output channels automatically and precisely.

Features & Benefits

Improves Process Performance

- Wider dynamic ratio control range and faster gas flow response resulting in shorter process cycle time and increased throughput
- Accurately controls flow ratio providing for better process optimization and repeatability
- Digital control loop provides rapid response to set point independent of the gas mix
- Embedded e-diagnostics increases tool uptime through reduction of “No Problem Found” product replacements
 - Ability to check functionality without removing the controller
 - Allows monitoring of performance parameters during operation

Easy to Integrate and Operate

- Straightforward configuration and diagnostics through Ethernet interface
 - Uses standard web browser, no special software required
 - Includes remote PC application
- Bright LED display provides easy viewing of flow ratio, temperature and Ethernet address

Reduces Costs and Complexity

- Fewer components than dual MFC arrangements reducing critical I/O costs
- Smaller footprint

Protected under one or more of the following U.S. patents: No. 6,418,954, No. 6,766,260, No. 7,007,007, US07621290B2 or International Patents and Patents pending.



Throughput and process control have always been critical to the semiconductor device manufacturer. With the advent of 300 mm wafers and dual process chambers, new methods of control gas flow distribution have become increasingly needed. 300 mm wafer processing often requires tunable control of gas distribution across the wafer to provide better process uniformity. Dual process chambers require proper gas distribution for chamber matching from single source gas panels.

The DELTA II flow ratio controller is the second generation of MKS DELTA controllers enabling process gas flow ratio range and faster development of chamber flow while being more adaptive to different tool and process conditions. MKS has developed a unique patent pending ratio control algorithm enabling ratio and flow response times of less than two (2) seconds (See Figure 1). This control algorithm also enables a twenty to one ratio control range, more than double its industry leading predecessor. The DELTA II maintains tight ratio control while input flow is changed (See Figure 2). All this in a more compact package with the additional features of web enabled setup and diagnostics.

The DELTA II's diagnostic feature allows the user to check the DELTA's performance in-situ, lowering costs through reduced removal of "No Problem Found" devices. This feature is enabled through a web browser utility accessed through the device's Ethernet port. This utility uses a standard web browser – no special software is required. For access, the IP address may be accessed through the devices bright LED display.

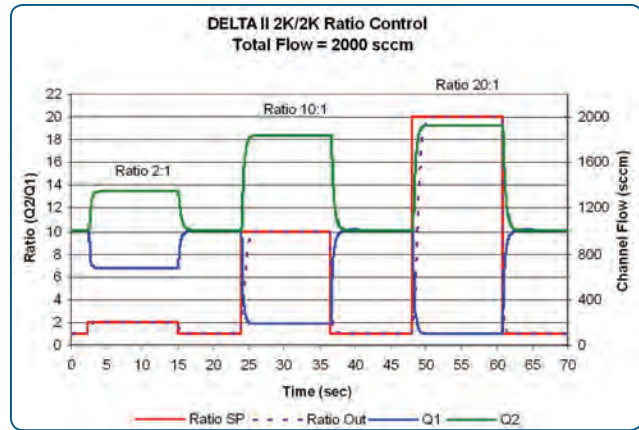


Figure 1 — Ratio Response

The DELTA II ratio controller has a dynamic ratio range of up to 20:1 with ratio response times under 2 seconds.

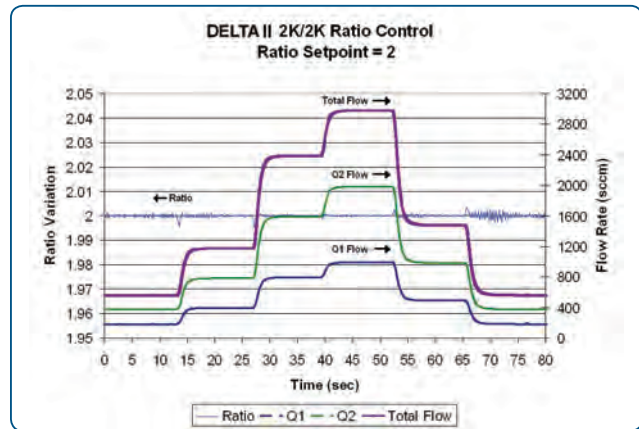


Figure 2 — Flow Response

The DELTA II ratio controller maintains ratio while input flow is changed.



Specifications

Performance

Full Scale Ranges (N ₂ equivalent)	500/500 sccm; 1000/1000 sccm; 2000/2000 sccm; 10000/10000 sccm
Maximum Operating Outlet Pressure ¹	200 Torr
Max. Allowable Outlet Pressure Differential	50 Torr (between Q ₁ and Q ₂)
Normal Operating Pressure Differential (N ₂)	<150 Torr (<450 Torr for 10000/10000)
Proof Pressure	1000 psig
Burst Pressure	1500 psig
Input Flow Range (N ₂ equivalent)	5 to 100% of each channel Full Scale rating
Ratio Control Range	1:1 to 20:1 and 20:1 to 1:1
Ratio Accuracy	±2% of ratio set point
Ratio Repeatability & Reproducibility	0.3% of ratio set point
Resolution	0.02% of channel Full Scale
Temperature Coefficient (per channel)	
Zero	0.05% Full Scale/°C
Span	0.08% Reading/°C
Ratio Settling Time	<2 seconds
Warm-up Time	30 minutes
Normal Ambient Operating Temperature	Units with Date Code "01xx16" and earlier, 10 to 40°C Units with Date Code "02XX16" and after, 10 to 40°C or 10 to 35°C (if unit mounted on 45°C hot plate)
Storage Temperature	-20 to 65°C
Storage Humidity	0 to 95% relative humidity, non-condensing
Temperature Display	0 to 100°C
Temperature Readout Units	°C
Temperature Accuracy	±2°C
Temperature Resolution	0.1°C

Mechanical

Fittings	Swagelok® 4 VCR® Inlet: male (non-rotatable) Outlets: male (non-rotatable)
Display	4 digits for value, 4 characters for unit
Leak Integrity	
External (scc/sec He)	<1x10 ⁻¹⁰
Through Closed Valve	<2% of Channel Full Scale at 400 Torr differential
Wetted Materials	316 S.S. VAR (equivalent to 316 S.S. SCQ for semiconductor quality); 316 S.S., Inconel®, KM-45, PTFE
Surface Finish	5 microinch average Ra
Weight	Less than 5 lbs. (2.3 kg)

Electrical

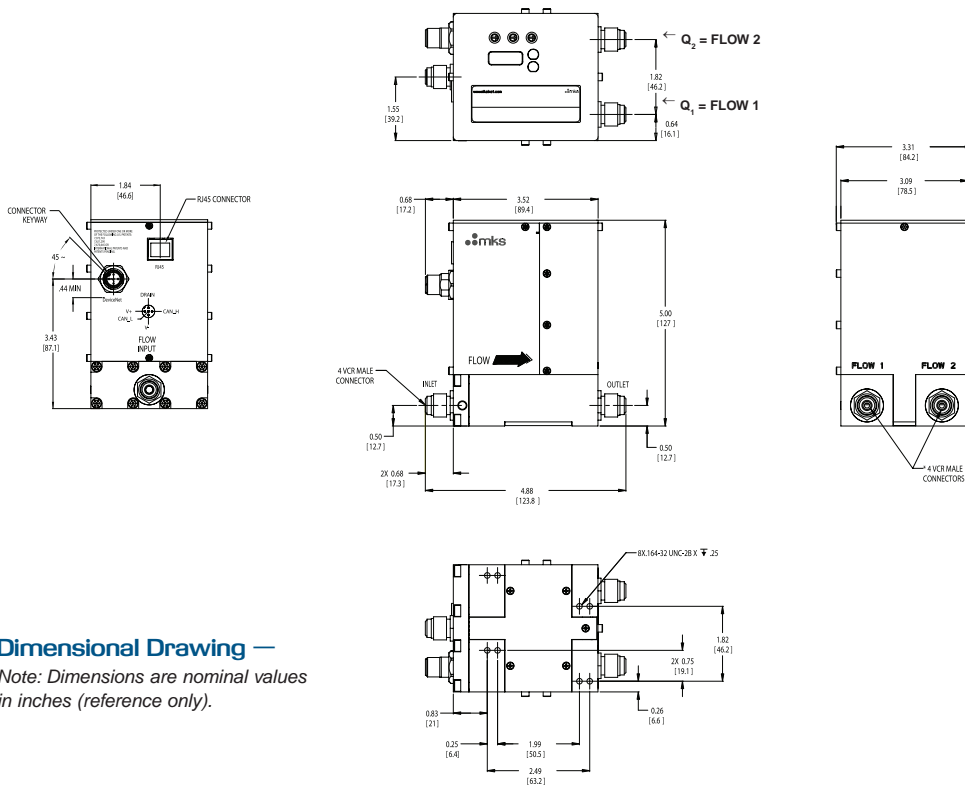
	Digital I/O	Analog
Connector	5 pin microconnector (DeviceNet™)	9 pin D male
Input Voltage	11-25 VDC	+15 to 24 VDC ±5%
Power Consumption	<9 Watts	<9 Watts
Set Point and Output Signals	Digital	0 to 5 VDC or 0 to 10 VDC

¹ The Delta II will operate with outlet pressures above 200 Torr. For device performance at higher pressures, consult factory.



Ordering Information

Ordering Code Example: DLT2A223163R121	Code	Configuration
DELTA II Flow Ratio Controller	DLT2A2	DLT2A2
Channel Flow Ranges (Flow 2/Flow 1) (XX)		
500/500	52	23
1000/1000	13	
2000/2000	23	
10000/10000	14	
For other ranges, Consult Factory		
Ratio (Flow 2:Flow1) (Y)		
1:1	1	1
Connector (B)		
Analog - 9-pin Type "D" (MKS pinout)	A	6
DeviceNet - 5 pin microconnector	6	
Control I/O (C)		
0 to 5 VDC (analog devices)	1	3
0 to 10 VDC (analog devices)	2	
DeviceNet (DeviceNet units must select 3)	3	
Control Type (A)		
Ratio: Q_2/Q_1 or Q_1/Q_2	R	R
Percentage: $Q_2/(Q_1+Q_2)$ or $Q_1/(Q_1+Q_2)$	P	
DeviceNet Units must select R		
Control Channel (Z)		
Q1 Control: Q_1/Q_2 or $Q_1/(Q_1+Q_2)$	1	1
Q2 Control: Q_2/Q_1 or $Q_2/(Q_1+Q_2)$	2	
Firmware (QQ)		
Firmware Revision	21	21
Unless otherwise specified, MKS will ship firmware revision current to date.		



Analog Pinouts 9 Pin Type D (not shown)

Pin	Description
1	Valve Open/Close
2	Ratio Signal Output
3	+15 VDC
4	Power Common
5	No connection
6	Ratio Set point
7	Signal Common
8	Signal Common
9	Remote Zero

Dimensional Drawing —
Note: Dimensions are nominal values in inches (reference only).



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