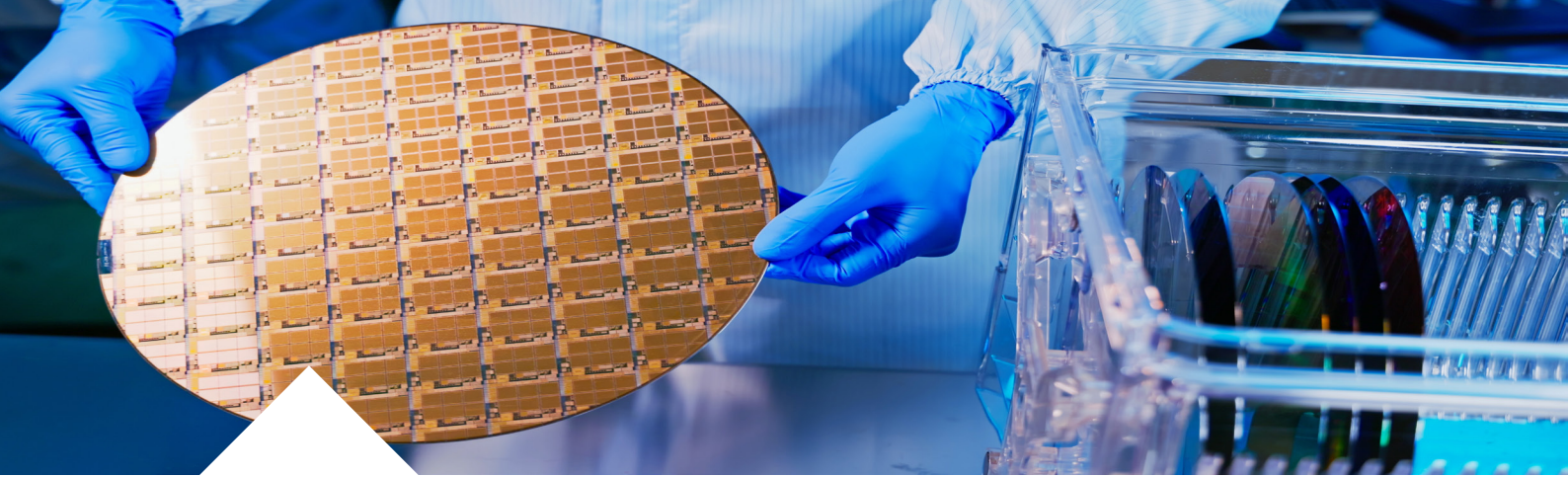


CMFC-6000  
Coriolis Mass Flow Controller

PSG  
a DOVER company



## CMFC-6000 Series Coriolis Mass Flow Controller With Pressure Transducer

### High Accuracy Integrated Coriolis Mass Flow Controller with Pressure Transducer

Delivering the highest available measurement and control accuracy of  $\pm 1\%$ , the CMFC-6000 Integrated Coriolis Flow Controller Series by Malema™ offers a line of highly accurate closed-loop flow controllers designed for use in the semiconductor industry. With integrated pressure transducer and patented Coriolis flow measurement technology, the CMFC-6000 provides superior performance in all operating conditions. This Malema Coriolis Flow Controller is used in a wide variety of high-purity applications including DI water and harsh chemicals.

### Superior Accuracy – Regardless of Density, Viscosity, Bubbles, or Temperature

Available in 1/4" or 3/8" port sizes, the CMFC-6000 includes models with flow control ranges starting at 50 grams per minute up to 4,000 grams per minute to within  $\pm 1\%$  accuracy of the set point, providing fast consistent control with a response time of less than two seconds.

### Easy Install, Drop-in Upgrade - Replacement for legacy DP flow controllers

This Coriolis mass flow controller is a drop-in upgrade for legacy differential-pressure flow controllers in post-CMP wet cleaning tools for 200 mm and 300 mm wafers. The legacy DP based flow controllers are inaccurate and prone to drift. The CMFC-6000 fits seamlessly into your tools while providing consistent accurate flow, preventing costly and wasteful sensor drift.

### Digital Signal Processing (DSP) Technology Ensures Reliability and Repeatability

Malema's advanced Coriolis Flow Technology, with enhanced digital signal processing, ensures precise flow measurements regardless of changes in density, viscosity, and temperature. The CMFC-6000 series is highly tolerant of fluids containing entrapped gases (bubbles), accurately measuring flow with up to 30% bubble presence. Malema Coriolis Flow Controllers minimize costly downtime, improve yield throughput, and increase operational profitability for the semiconductor industry.



## Key Features

- **Patented Coriolis Technology:** Offers the market's only high-purity plastic Coriolis flow controller.
- **High Accuracy:** Controls flow rate within  $\pm 1\%$  of setpoint; ideal for fluid blending, dispensing applications, and reducing chemical consumption.
- **Fast Response Time:** Fast response of two seconds (typically less than one second for most applications) to set point changes, ensuring steady and consistent chemical delivery.
- **PTFE/PFA Wetted Parts:** Compatible with UHP liquid chemicals, DI water, and cleaning chemistries.
- **Handles Two-Phase Flow:** Operates and measures conditions with entrapped gas up to 30% void fraction.
- **Versatile Sizing:** Available in 1/4" and 3/8" sizes, with a flow control range between 50 to 4,000 grams per minute.
- **Independent Mass Flow Measurement:** Accuracy is independent of fluid density and viscosity, eliminating the need for recalibration with different fluids
- **Flow Regimen Flexibility:** Accuracy is unaffected by laminar or turbulent flow, or variations in flow velocity profile.
- **Pressure Sensor:** Integrated pressure sensor provides tool control with the expected fluid pressure signal.
- **Dynamic Temperature Compensation:** Built-in temperature sensor enables real-time fluid temperature compensation.

## Operation

The CMFC-6000 Flow Controller integrates a highly accurate PFA Coriolis Flow Sensor, a PFA pressure sensor, a control valve, and advanced flow control electronics, featuring high-purity plastic wetted components.

The tool's PLC sends the desired flow control setpoint signal to the CMFC-6000. The flow control electronics then compares the measured flow rate to the setpoint and adjusts the control valve using Malema's advanced PID algorithms to achieve precise flow control. The high-speed precision stepper motor-actuated diaphragm valve in the CMFC-6000 ensures fast and accurate response with minimal overshoot.

The integrated high-purity pressure sensor allows the CMFC-6000 to provide the tool with all expected fluid monitoring signals of legacy differential pressure-based flow controllers after the upgrade is completed.

## Applications

- **Wet Cleaning and Etching Tools:** A drop-in replacement for older, less-accurate flow controller technologies, providing improved control when blending and delivering cleaning chemistries.
- **Copper Plating Tools:** Well-suited for chemical mixing and dispensing applications.

## Performance Specifications

Available Flow Range Models	50 – 250 g/min
	50 – 500 g/min
	100 – 1000 g/min
	150 – 1500 g/min
	200 – 2000 g/min
	250 – 2500 g/min
	400 – 4000 g/min (3/8" connections only)
	500 – 5000 g/min (3/8" connections only)
Accuracy* (for room temperature DIW)	±1% of set point or ±3 g/min (whichever is larger)
Control Repeatability	±1% of set point or ±1.5 g/min (whichever is larger)
Flow Control Time	< 2 sec
Fluid Temperature	18 – 50°C*
Ambient: Temperature/Humidity	0 – 40°C / 30 – 80% RH, without dew
Maximum Expected Operating Pressure	50 psig
Maximum Safe Internal Pressure	70 psig

\* Consult the factory for higher temperature applications

## Electrical Specifications

Power Supply Input	24 V DC ± 10%
Power Consumption	6W ~ 0.25 A (Power on: inrush current 0.7A)
Control Signal In*	0 – 5 V DC, 0 – 10 V DC, or 4 – 20 mA
Flow Signal Out*	0 – 5 V DC, 0 – 10 V DC, or 4 – 20 mA**
Pressure Signal Out*	0 – 5 V DC, 0 – 10 V DC, or 4 – 20 mA active
Temperature Signal Out*	0 – 5 V DC, 0 – 10 V DC, or 4 – 20 mA active

\* Other options available

\* Consult the factory for other options

## Material Specifications

Wetted Parts	High Purity PFA, PTFE
Enclosure Parts	PEEK, Acrylic, Vinyl, PVC*, PVDF

\* Flame retardant

## Physical Specifications

Mounting Orientation	Horizontal or Vertical
Fluid Connections	Inlet/Outlet: 1/4" or 3/8", Flare or Pillar
Ingress Rating	IP65

# Power and Signal Connections

(Refer to drawing for custom parameters)

It is always recommended to use a dedicated power supply with 24 V DC ( $\pm 10\%$ ), 500mA.

The configuration of the 12 pin connector and its mating cable is given in the table below.

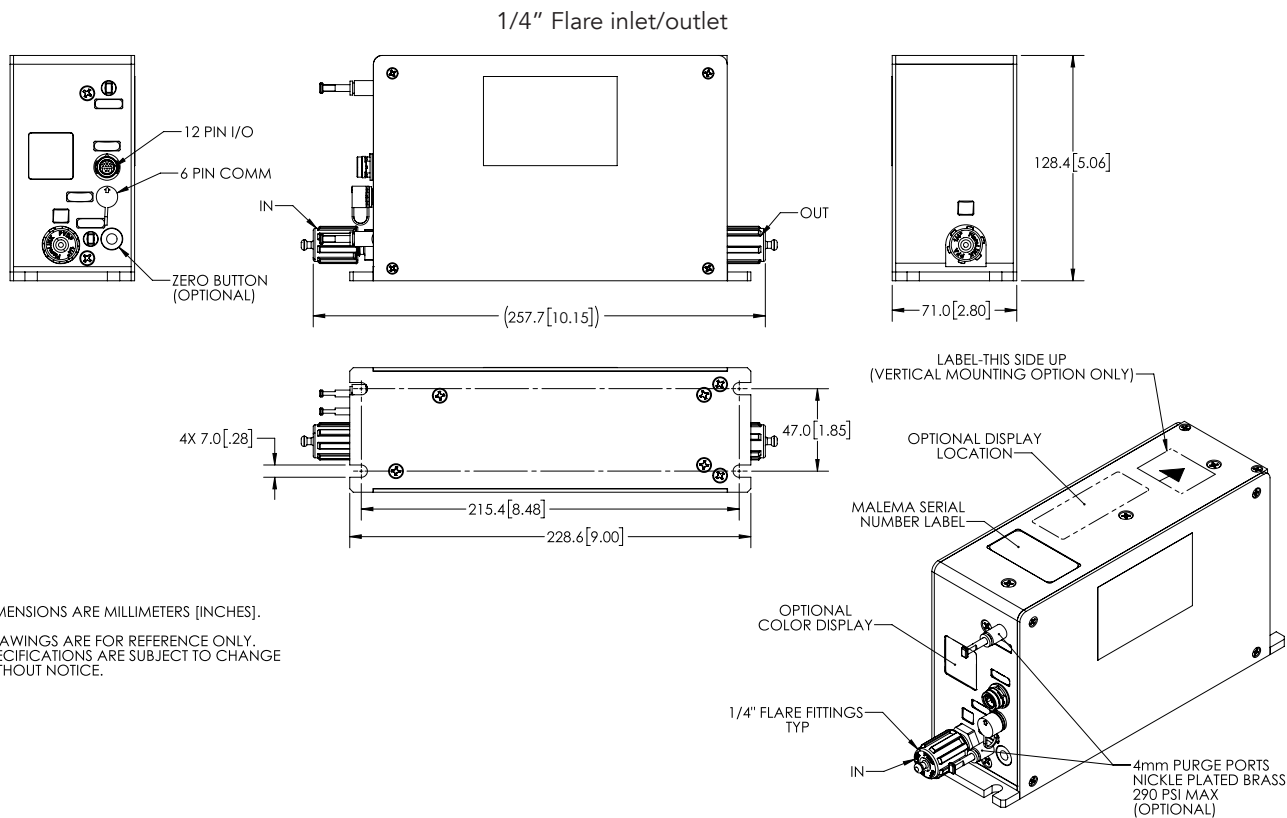
A USB communication cable can be ordered separately to interface with the PC GUI program.

12 Pin Connector Configuration				
Pin No.	Wire Color	Description	Specification	Remarks
1	Red	Power (+) 24 V DC	24 V DC $\pm 10\%$	
2	Black	Power (-) 0 V DC		
3	Pink	Set Point (+)	4 – 20 mA or 0 – 10 V DC	
4	Gray	Set Point (-)		
5	Blue	Flow Out (+)	4 – 20 mA (Max. load 900 ohm) or 0 – 10 V DC	
6	White	Flow Out (-)		
7	Red/Black	D Input/Output 2 (+)		Configurable
8	White/Black	DIO (-)		
9	Yellow	D Input/Output 1 (+)		Configurable
10	Brown	DIO (-)		
11	Green	Zero Adjust*		Pull up to power supply voltage starts the zero adjustment
12	Violet	No Connection		

\* Make sure the flow is completely stopped before zero adjust.

# Dimensional Drawing (Typical Horizontal Modules)

FOR REFERENCE ONLY



Consult with the factory for other sizes and configurations, including vertical mount

## Ordering Information

Model Code																Description
CMFC-6	***	-	F	*	*	**	*	*	-	*	*	*	-	***		
Sensor Size	031														3 mm sensor in serial configuration	
	032														3 mm sensor in parallel configuration	
		-														
Wetted Material			F												PFA Sensor (+Pt cured silicone for P valve type) or (+PTFE for N valve type)	
Connection Size				2											1/4" OD	
				3											3/8" OD	
Connection Type				2											Flare (Male)	
				3											Super Pillar 300 (Female)	
Flow Control Range					04										50 – 500 g/min (Avaliable in 1/4" Size with 031 sensor)	
					05											100 – 1000 g/min (Avaliable in 1/4" Size with 031 sensor)
					06											150 – 1500 g/min (Avaliable in 1/4" Size with 031 sensor)
					07											200 – 2000 g/min (Avaliable in 3/8" Size with 032 sensor)
					08											250 – 2500 g/min (Avaliable in 3/8" Size with 032 sensor)
					09											300 – 3000 g/min (Avaliable in 3/8" Size with 032 sensor)
					10											400 – 4000 g/min (Avaliable in 3/8" Size with 032 sensor)
Input (Set Point)					1										Current: 4 – 20 mA (Note: 4 mA = 0 g/min, 20 mA = Max flow for corresponding range)	
					2											Voltage: 0 – 10 V DC (Note: 0 V DC = 0 g/min, 10 V DC = Max flow for corresponding range)
					3											Voltage: 0 – 5 V DC (Note: 0 V DC = 0 g/min, 5 V DC = Max flow for corresponding range)
Flow Output					1										Current: 4 – 20 mA (Active) (Note: 4 mA = 0 g/min, 20 mA = Max flow for corresponding range)	
					2											Voltage: 0 – 10 V DC (Note: 0 V DC = 0 g/min, 10 V DC = Max flow for corresponding range)
					3											Voltage: 0 – 5 V DC (Note: 0 V DC = 0 g/min, 5 V DC = Max flow for corresponding range)
Pressure Output					1										Current: 4 – 20 mA (Passive) (Note: 4 mA = 0 psi, 20mA = 70 psig)	
					2											Voltage: 0 – 10 V DC (Note: 0 V DC = 0 psi, 10 V DC = 70 psig)
					3											Voltage: 0 – 5 V DC (Note: 0 V DC = 0 psi, 5 V DC = 70 psig)
Valve Type										N					Diaphragm Valve (Available in 1/4" and 3/8" connection sizes and in sensor sizes 031 and 032 )	
										X						Not applicable
Mounting Orientation										H					Horizontal	
										V						Vertical
Accessories										1					Supplied without I/O cable	
										2						Supplied with 5 meter I/O cable
														-		
															S01	Standard Version
															XXX	Custom Version (Factory will assign alphanumeric 3 digit number)

\* CMFC-6032-F3 Only



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Where Innovation Flows

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