Ultra Compact UHP Liquid Flow Controllers

Model U803 & U804 INTEGRATED LIQUID FLO-CONTROLLERS

UHP LIQUID

APPLICATION IDEAS

Upgrading peristaltic-pump based chemical delivery systems

Automated online blending, spiking, and dosing

Precision batching and dispensing

PRODUCT DESCRIPTION

McMillan Model U803 & U804 UHP FLO-CONTROLLERS will precisely measure and control flow rates of virtually any fluid as low as 7 mLpm or as high as 1 Lpm. Repeatable results are achieved by using a patented* microturbine flow sensor design. This design, unlike traditional paddlewheel designs, provides accurate flow measurement with no particle generation. An integrated proportional control valve is utilized to regulate flow rate. PTFE, perfluoroelastomers, and sapphire wetted parts ensure compatibility with chemicals commonly found in microelectronics manufacturing processes, including deionized water, CMP slurries, acids, solvents, and photoresist.

Each unit is individually calibrated before shipment, and a certificate of calibration accompanies all FLO-CONTROLLERS. A repeatability capability of ±0.2% full scale reassures process engineers of consistent results.

PRINCIPLE OF OPERATION

The U803 & U804 Liquid FLO-CONTROLLERS integrate the sensing element with an advanced proportional control valve to regulate flow rate. This concept is very similar to the operation of mass flow controllers (MFC's) for gases. An analog signal is provided to the FLO-CONTROLLER as a set point. That signal is processed and compared to the actual flow rate, which is provided in realtime by the integrated sensor. Any difference between the two signals results in adjustments to the internal valve, thus automatically maintaining the requested flow rate.

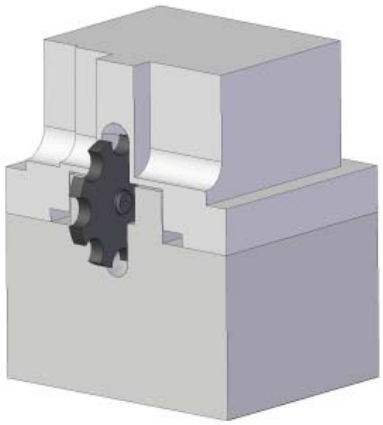


Figure 1. Cutaway of sensor technology.

McMillan's patented* microturbine technology utilizes the Pelton turbine wheel concept. This design allows for use of a minature microturbine wheel about 0.5 inches (12 mm) in diameter. The wheel is supported on a small sapphire shaft, held in position by two sapphire bearings. Due to the low mass of both the wheel and the shaft, the microturbine wheel virtually floats in the liquid. This flotation effect causes the turbine wheel to be suspended in the middle of the bearings and thus eliminates shaft and bearing wear. Therefore, no particles are generated.

As flow passes through the FLO-SENSOR, it is directed onto the very small teeth of the wheel using a precision-machined nozzle. This nozzle is sized according to the flow range of the unit. The rotational speed of the turbine wheel increases proportionally to the volumetric flow rate.

The microturbine wheel features small openings, evenly spaced around the center of the wheel. As the wheel rotates, a light beam is projected through the PTFE body and onto the wheel. A light detector on the other side of the wheel detects each opening and translates those signals into pulses. As the wheel spins faster, pulse rate increases. When the wheel stops (under zero flow conditions), no pulses are generated. Consequently, zero drift is not possible and zero adjustments are never required.

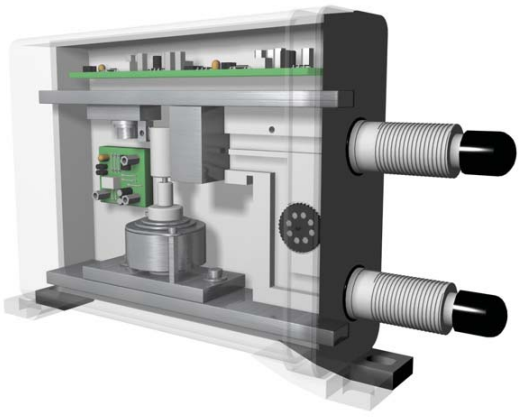


Figure 2. Typical interior view.

Processing circuitry provides an analog output that is linearly proportional to the flow rate. If the set point differs from the actual flow rate, the amount of error is assessed and the valve opens or closes accordingly.

McMillan UHP

* US Patents 4,467,660; 5,542,302; 5,728,949; 7,051,757; 7,426,875. Other patents pending.

FEATURES AND OPTIONS

FLOW PATH TYPE
The Model U803 FLO-CONTROLLER has a space saving design with the inlet and outlet on the same side. The Model U804 FLO-CONTROLLER is an inline unit particularly suitable for applications where an exisiting unit needs to be replaced.

FLOW RANGES
Flow ranges from 7-50 mLpm up to 100-1,000 mLpm are available. Consult the factory for custom requirements.

POWER
Units operate with 24 VDC power.

SIGNAL CONFIGURATION
Units may be ordered with a 4-20 mA, 0-5 VDC, or 0-10 VDC configuration.

ACCURACY/LINEARITY
All models have an accuracy specification of ±1.0% full scale (including linearity).

CALIBRATION
All units are calibrated at the factory using deionized water. Calibration curves may be requested for fluids with viscosities differing from water.

FLUID CONNECTIONS
All units have male Flaretek® compatible connections. Non-standard connection types may be available upon request.

ELECTRICAL CONNECTIONS
All units have an integrated 7-pin connector. Several mating cable options are available.

WETTED MATERIALS
All units have only PTFE, perfluoroelastomers, and sapphire as wetted parts.

Model U803 Space Saving FLO-CONTROLLER

Model U804 Inline FLO-CONTROLLER

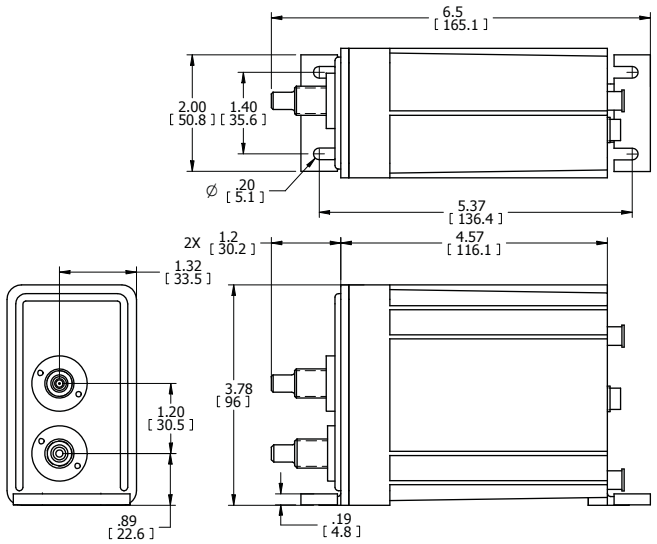
SPECIFICATIONS

	U803 & U804
Accuracy (including linearity, best fit straight line)	±1.0% Full Scale
Repeatability Capability	±0.20% Full Scale
Pressure Rating	80 psig (5.4 bar) maximum working 100 psig (6.8 bar) overpressure
Temperature Rating (Fluid)	Standard: 5 to 45ºC
Temperature Rating (Environmental)	Operating: 5 to 45ºC Storage: 0 to 60ºC
Wetted Materials	PTFE Sapphire
O-Ring Material	Perfluoroelastomer*
Exterior Surfaces	PTFE Polypropylene PVC Polyester
Recommended Filtration	20 microns or less
Compatible Fluids	Low viscosity (<10 cS) Minimum amount of entrained air
Valve	PTFE cam-driven diaphragm Not recommended for positive shutoff
0-5 VDC Output	0 VDC at zero flow 2.5 Kohm or greater output load Not isolated
0-10 VDC Output	0 VDC at zero flow 5 Kohm or greater output load Not isolated
4-20 mA Output	4 mA at zero flow 250 ohm maximum current loop Not isolated
0-5 VDC Input	0 VDC at zero flow Input load is 100 Kohms
0-10 VDC Input	0 VDC at zero flow Input load is 100 Kohms
4-20 mA Input	4 mA at zero flow Input load is less than 50 ohms
Standby Mode	Disables valve (freezes) Automatically engaged when set point is <5% of full scale
Zero Drift	None
Warm-Up Time	None
Calibration Interval	Calibration should typically be verified once every 12 months
Power Requirements	22-25 VDC 250 mA typical (1 A peak)
Electrical Connections	7-pin connector Nylon housing when used with CVx cables
Response Time	Typically <3 seconds for 97% of final value
Reliability	100,000 Hours MTBF(testing ongoing)
Certifications	CE Approved 89/336/EEC (EN 55011 & EN 50082-1) 73/23/EEC Low Voltage Directive
Ratings	IP64 (NEMA 4X)

* contact factory for current compound

DIMENSIONS

Model U803 FLO-CONTROLLER
Dimensions shown are in inches(mm).



Model U804 FLO-CONTROLLER
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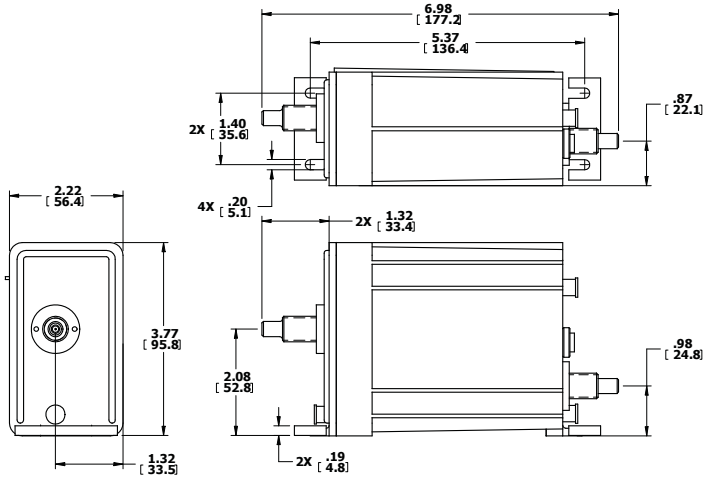
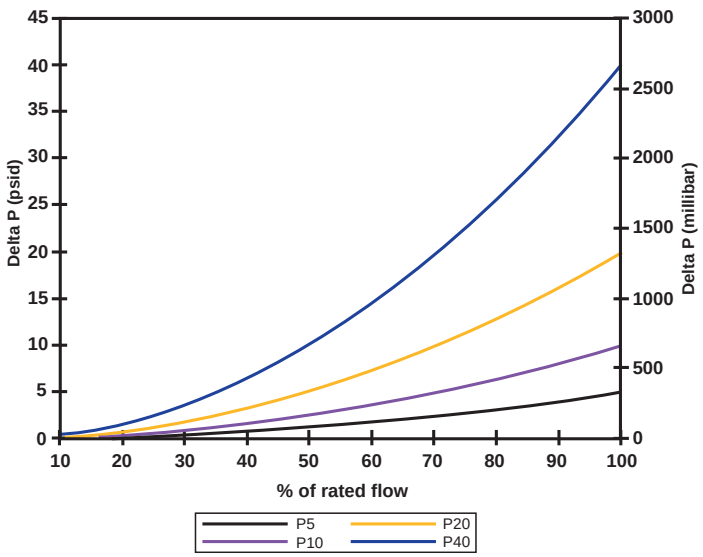
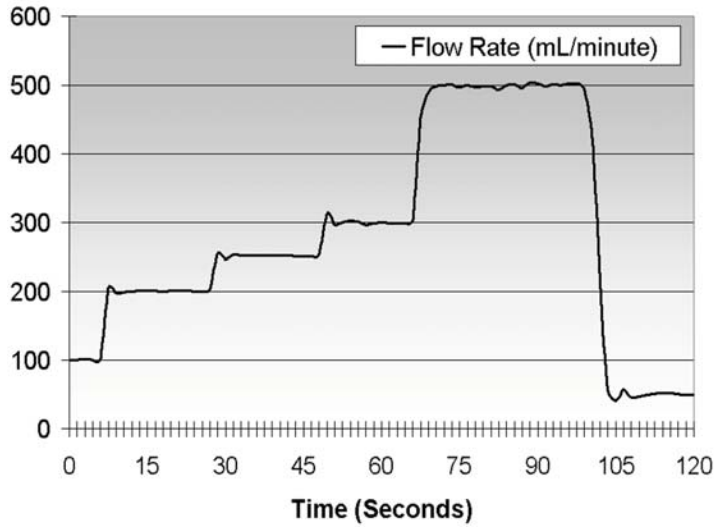


PRESSURE DROP

Maximum Pressure Drop for Different Valve Configurations
(may vary +10% of indicated value)



RESPONSE TIME EXAMPLE



Typical data from a 500 mLpm FLO-CONTROLLER with P20 valve configuration. Other configurations may increase or decrease response time.

ORDERING INFORMATION

Form part number as follows: (Model Code) - (Flow Range) - (Power/Signal) - (Fittings) - (Mating Cable) – (Options).	Code
U803 UHP Liquid FLO-CONTROLLER U804 UHP Liquid FLO-CONTROLLER	U803 U804
Flow Range (mLpm of H_2O) 7-50 15-100 20-200 50-500 100-1000	 2 3 4 5 6
Power / Signal Configuration 22-25 VDC Power / 0-5 VDC I/O 22-25 VDC Power / 0-10 VDC I/O 22-25 VDC Power / 4-20 mA I/O	 B J C
Fittings 1/4” male flare (Flaretek® compatible)	 F4
Differential Pressure Configuration 2-10 psid 4-20 psid 5-40 psid 7-50 psid 10-60 psid	 P5 P10 P20 P25 P40
Mating Cable None (not recommended) PVC-jacketed, 6 feet (1.85 m) PVC-jacketed, 12 feet (3.7 m)	 C0 CV6 CV12
Options Include Pair of PVDF Flare Nuts	 FN

Example:

U804-5-J-F4-P20-CV12 would give you a U804 FLO-CONTROLLER rated for 50-500 mLpm. The input/output signals would be 0-10VDC. Fluid connections would be 1/4” male flare fittings. A PVC-jacketed 12 foot (3.7 m) cable would be included.

McMillan Company
P.O. Box 1340
Georgetown, Texas 78627

Toll-Free: 800.861.0231 (U.S.A. only)
Direct: 512.863.0231
Fax: 512.863.0671

Email: sales@mcmflow.com
Website: www.mcmflow.com

McMillan UHP

Viton – Reg TM E.I. DuPont Dow Elastomers LLC

Flaretek – Reg TM Entegris, Inc.

Bulletin U803-S001

Specifications subject to change without notice.

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