

COMPACT LIQUID FLOW CONTROLLERS

U80X Series

Integrated Liquid Flow Controller



APPLICATION IDEAS

- Precision batching and dispensing
- Automated online blending, spiking, and dosing
- Micro electronics manufacturing

Product Description

McMillan Flow Product's U80X Series flow controller will precisely measure and control flow of virtually any fluid, achieving rates as low as 13 mL/min or as high as 10 L/min. Repeatable results are attained 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, FFKM, and Sapphire wetted parts ensure compatibility with chemicals commonly found in microelectronics manufacturing processes, including deionized water, CMP slurries, acids, solvents, and photoresists.

Each unit is individually calibrated before shipment, and a certificate of calibration accompanies each flow controller. A repeatability specification of $\pm 0.2\%$ full scale reassures process engineers of consistent results.

Principle of Operation

McMillan's U80X Series flow controller integrates 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 flow 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, automatically maintaining the requested flow rate.

McMillan's microturbine wheel technology utilizes the Pelton turbine wheel concept. This design allows for use of a miniature turbine wheel. The wheel is supported on a very small sapphire shaft, held in position by two maintenance-free bearings. Due to the light weight of both the wheel and the shaft, the microturbine wheel is virtually suspended in the flow path. This suspension effect relieves force on the shaft and bearings, eliminating wear.

As flow passes through the flow sensor, it is directed onto the very small teeth of the wheel using a precision-machined nozzle (As shown with blue arrows in Figure 1). 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 has translucent sections integrated into the wheel. An infrared emitter (as shown with red in Figure 1) is located on one side of the wheel, and a sensor on the other. As the wheel rotates, (as shown with green arrows in Figure 1) the infrared beam is alternately interrupted and passed through, detecting wheel speed based on flow. As the wheel spins faster, the 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.

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. If the flow controller cannot reach the set point, it will provide an alarm.

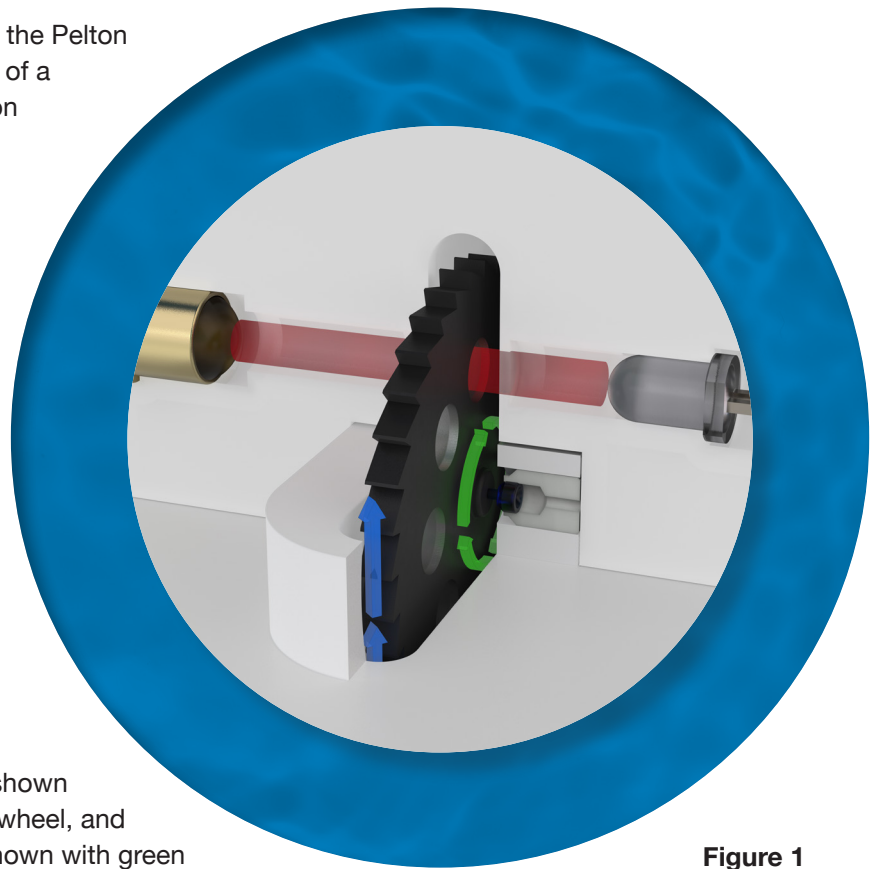


Figure 1
Representation of microturbine technology

Features

FLOW RANGES

Flow ranges from 13 – 100 mL/min up to 1.0 – 10.0 L/min are available. Consult the factory or authorized representative for custom requirements.

COMPACT DESIGN

U80X flow controller has a space saving design with the inlet and outlet on the same side.

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 $\pm 1.0\%$ 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 flare compatible connections.

ELECTRICAL CONNECTIONS

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

WETTED MATERIALS

All units have only PTFE, FFKM, and Sapphire as wetted parts.



MODEL U802



MODEL U803



FITTINGS

Specifications

Except where noted, all specifications apply to operation at 25 °C

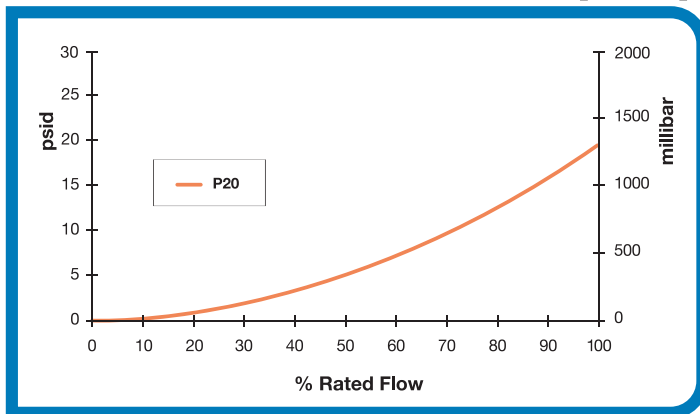
U80X Series		
	U802	U803
Accuracy (including linearity, best fit straight line)	± 1.0% full scale	
Repeatability Capability	± 0.20% full scale	
Pressure Rating	100 psig [6.8 barg] burst pressure 80 psig [5.4 barg] max operational	80 psig [5.4 barg] burst pressure 50 psig [3.4 barg] max operational
Temperature Rating (Fluid)	32 to 131 °F [0 to 55 °C]	41 to 113 °F [5 to 45 °C]
Temperature Rating (Environmental)	Operating: 32 to 122 °F [0 to 50 °C] Storage: 32 to 158 °F [0 to 70 °C]	Operating: 41 to 113 °F [5 to 45 °C] Storage: 32 to 140 °F [0 to 60 °C]
Wetted Materials	PTFE FFKM Sapphire	
Seal Material	FFKM	
Recommended Filtration	20 microns or less	
Compatible Fluids	Low viscosity (< 10 cSt) 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 500 ohm maximum current loop Not isolated	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 Isolated from ground	0 VDC at zero flow Input load is 100 Kohms
0-10 VDC Input	0 VDC at zero flow Input load is 100 Kohms Isolated from ground	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 Isolated from ground	4 mA at zero flow Input load is less than 50 ohms

Specifications

Except where noted, all specifications apply to operation at 25 °C

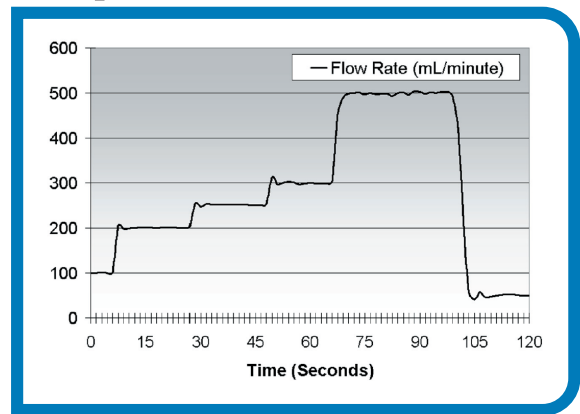
U80X Series		
	U802	U803
Standby Mode	Disables valve (freezes) Automatically engaged when set point is < 5% of full scale	
Error Output	Activated when controller cannot achieve setpoint Error condition = high (V+) Normal condition = low Automatically resets upon normal condition Typical delay before activated: 8 - 10 seconds	None
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	
Response Time	Typically < 3 seconds for 97% of final value	
Reliability	100,000 Hours MTBF	
Certifications	CE Approved 89/336/EEC (EN 55011 & EN 50082-1) 73/23/EEC Low Voltage Directive UKCA	
Ratings	IP64 (NEMA 4X)	

Differential Pressure Drop (Max)



Maximum allowed differential pressure drop across flow range. May vary +10 % of indicated value.

Response Time

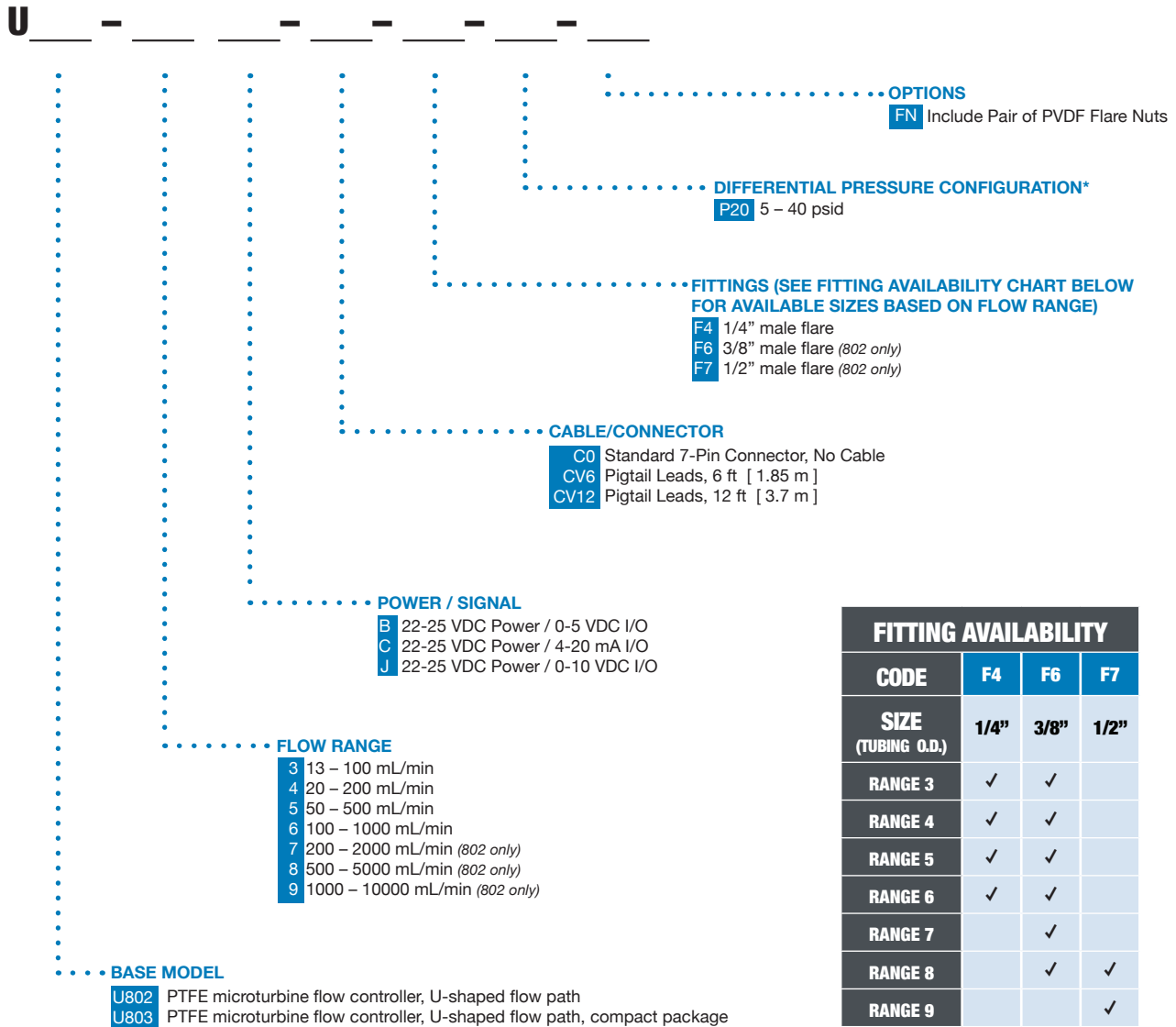


Typical data from a 500 mL/min flow controller with P20 valve configuration. Other configurations may increase or decrease response time.

Ordering Information

Form part number as follows:

(Base Model) - (Flow Range) (Power/Signal) - (Cable/Connector) - (Fittings) - (D P Configuration) - (Options)



FITTING AVAILABILITY			
CODE	F4	F6	F7
SIZE (TUBING O.D.)	1/4"	3/8"	1/2"
RANGE 3	✓	✓	
RANGE 4	✓	✓	
RANGE 5	✓	✓	
RANGE 6	✓	✓	
RANGE 7		✓	
RANGE 8		✓	✓
RANGE 9			✓

EXAMPLES

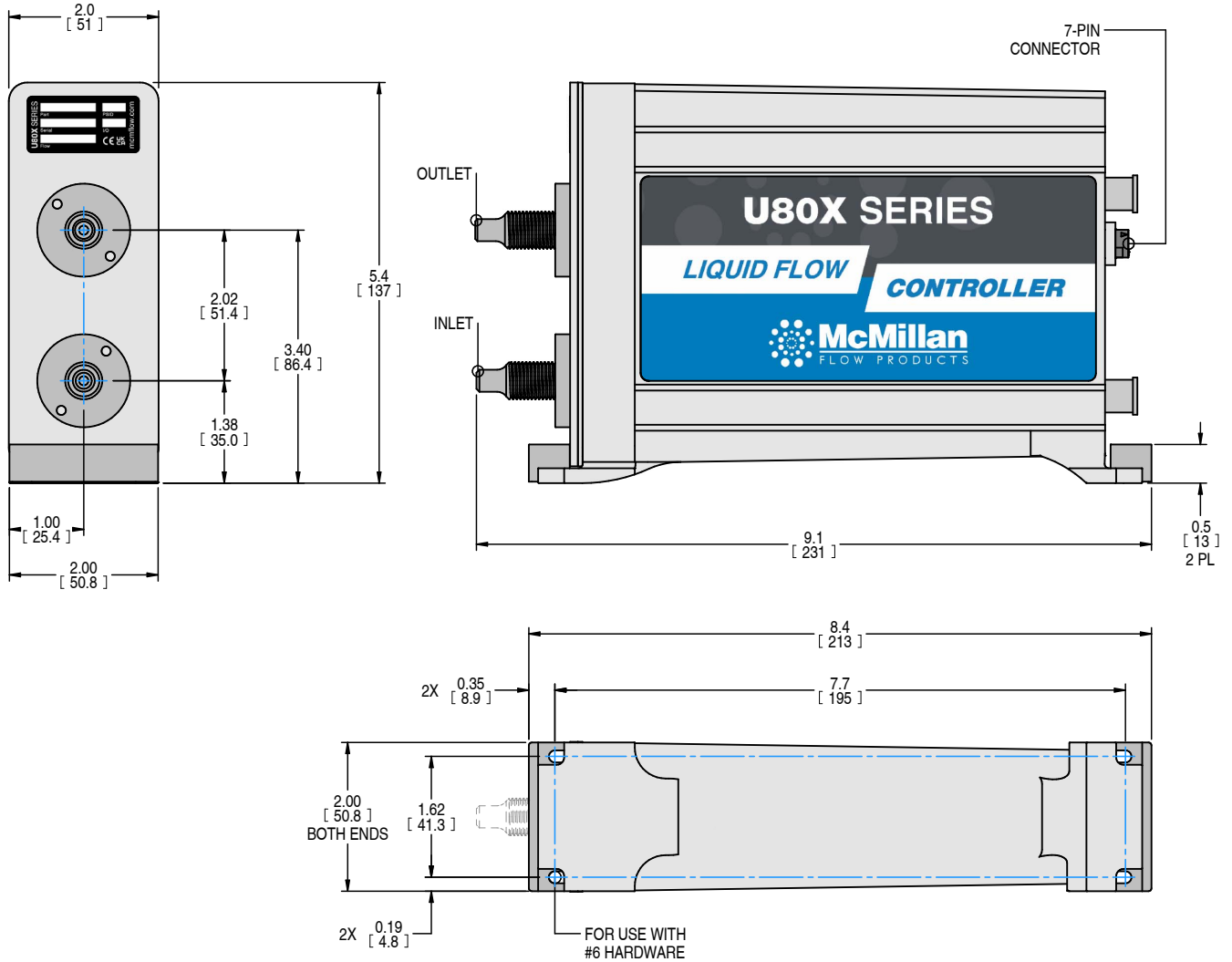
U802-6J-CV12-F6-P20-FN provides a U802 PTFE microturbine flow controller rated for 100 – 1000 mL/min, with input/output signals of 0-10 VDC, 12 foot [3.7 m] cable terminated with pigtail leads, fluid connections of 3/8" male flare fittings, differential pressure configuration of 5 – 40 psid, and a pair of PVDF flare nuts.

U803-4B-CV6-F4-P20 provides a U803 PTFE microturbine flow controller compact package rated for 20 – 200 mL/min, with input/output signals of 0-5 VDC, 6 foot [1.85 m] cable terminated with pigtail leads, fluid connections of 1/4" male flare fittings, and differential pressure configuration of 5 – 40 psid.

Dimensions

Basic unit configurations are shown. Contact factory or an authorized representative for dimensions of units not shown. All dimensions shown in inches [mm] unless otherwise noted.

MODEL U802

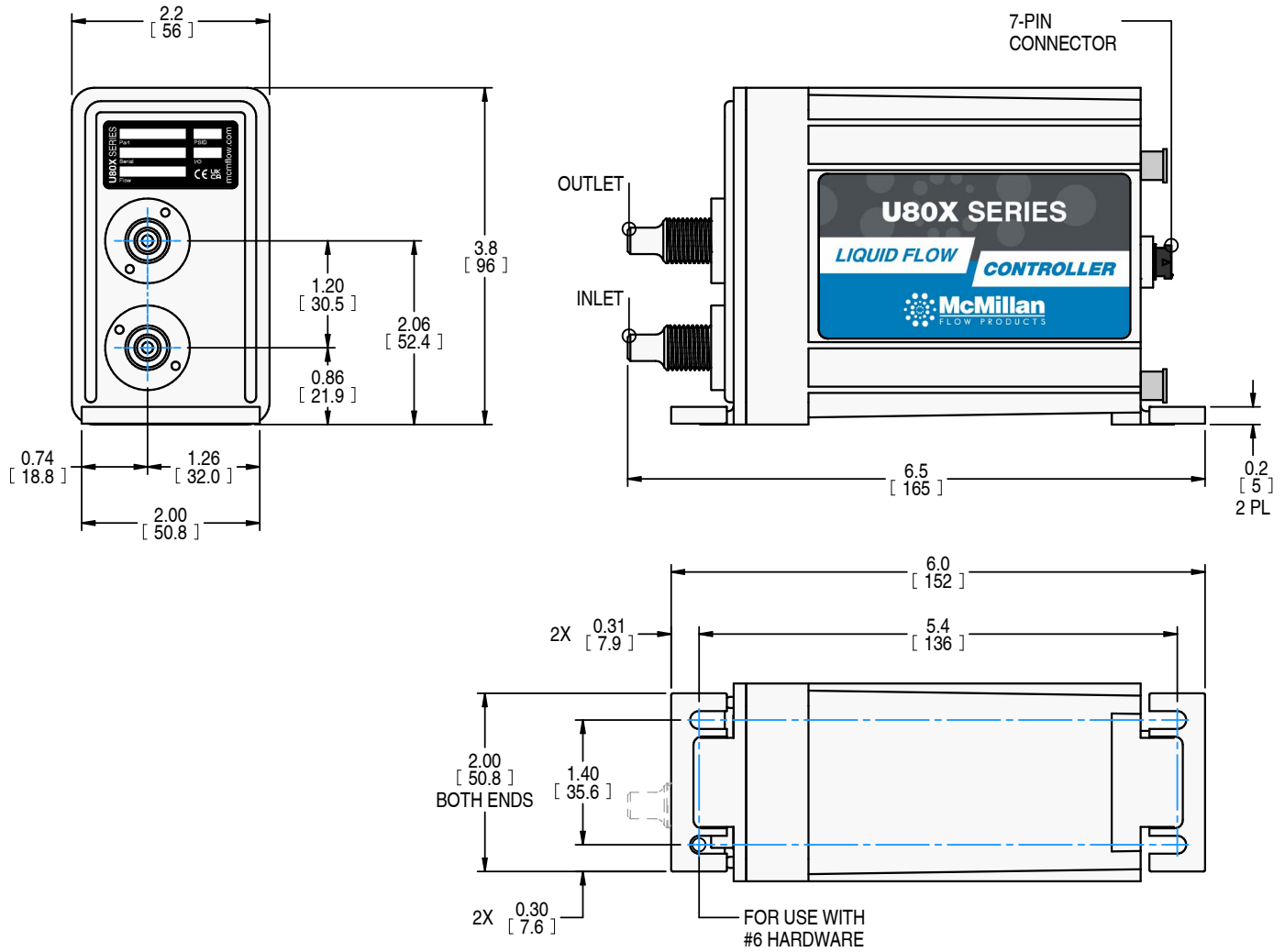


OVERALL LENGTH			
CODE	F4	F6	F7
LENGTH	4.2 [105]	4.2 [105]	4.3 [109]

Dimensions

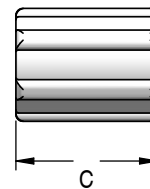
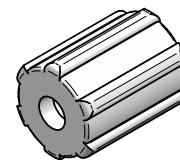
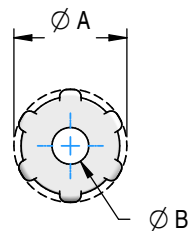
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MODEL U803

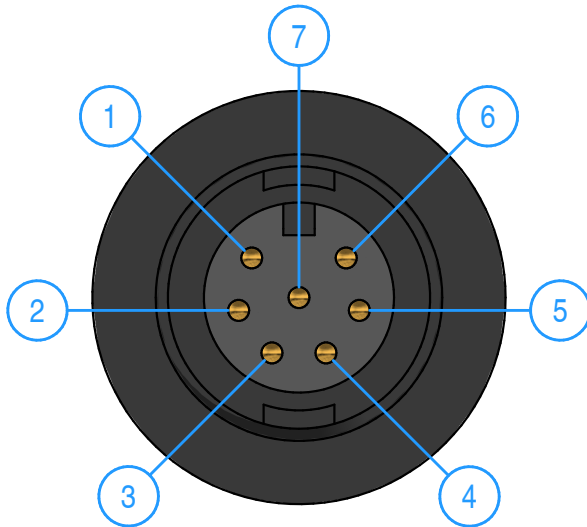


FLARE NUT DIMENSIONS

VARIABLE DIMENSIONS			
CODE	Ø A	Ø B	C
F4	0.78 [19.8]	0.26 [6.6]	1.0 [25.4]
F6	0.90 [22.9]	0.38 [9.6]	1.0 [25.4]
F7	1.0 [25.4]	0.50 [12.7]	1.1 [27.9]



Wiring Diagram



PIN	FUNCTION
1	Control Input +
2	Power Ground / Common
3	Control Input -
4	Output Common
5	Output Signal
6	Power +
7	Error Output

Related Products



10X Series Flow Sensors

Microturbine flow sensors
for liquids and gases



IRIDIUM Flow Controllers

Modular flow controller platform
for liquid applications



OSMIUM Flow Switch

Thermal flow switch
for liquid applications



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