LIQUID

McMillan FLOW PRODUCTS

MODULAR FLOW CONTROLLERS FOR LIQUID APPLICATIONS

IRIDIUM Series Flow Controllers

APPLICATION IDEAS

On-demand chemical dilution and blending

Sample flow rate regulation

Consumable usage monitoring and regulation

Product Description

IRIDIUM is a platform for configurable flow control. Its modular design allows for a single device to adapt to a variety of flow conditions and applications. The primary unit features the exterior case, touchscreen, connectors, and rails for flow path blocks.

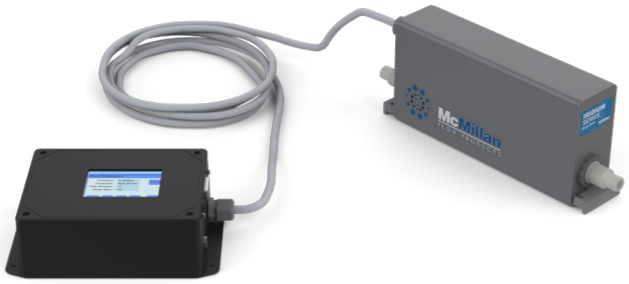
There are two packages for the IRIDIUM series flow controller; an Integrated Package where all electronics and interfaces are contained in a single case, and a Remote Display Package with two cases, where the touchscreen and wiring ports are mounted remotely from the flow path blocks.

A 3.2" [81 mm] LCD color touchscreen is included in both packages. This touchscreen allows for monitoring of flow rate, inputting data, and configuring the unit on site. In addition, RS485 serial and USB communications are standard for remote interfacing.

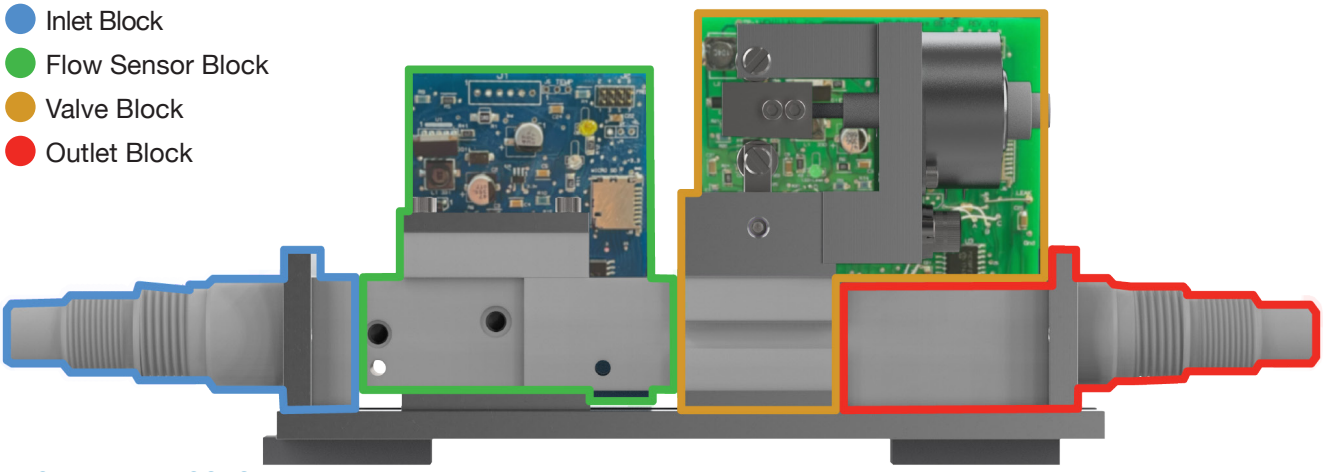
The IRIDIUM flow unit accepts four flow path blocks: 1) inlet block; 2) flow sensor block; 3) valve block; and 4) outlet block (See flow path blocks diagram below.) In addition, it features two expansion slots for enhanced I/O functionality.

Factory-built configurations are available in both the Integrated and Remote Display Packages. To simplify configuration, these combine compatible flow path blocks to allow the ordering of one part number for a complete solution.

INTEGRATED PACKAGE



REMOTE DISPLAY PACKAGE



FLOW PATH BLOCKS

Features

POWER

The IRIDIUM platform requires 24 VDC power. Various power adapters are also available for use as needed. The unit cannot be powered through the USB port.

SIGNAL INPUTS/OUTPUTS

All units can be completely controlled through the on-board touchscreen. In addition, full remote control is available through the RS485 serial connection, and limited control is available through the USB port. An optional expansion module also adds analog I/O functionality (EAA module).

SOFTWARE UPDATE

The IRIDIUM platform can easily be customized through downloadable firmware updates via the micro-USB port. The factory can provide custom software packages with unique configurations to match specific applications or process conditions.

ELECTRICAL CONNECTIONS

A 15-pin D-SUB connector provides all power and signal connections to the IRIDIUM, with the exception of the USB port. Various adapters and hubs are available to adapt the connector to wiring terminals or other interfaces.

DISPLAY

All IRIDIUM packages incorporate a 3.2” [81 mm] color touchscreen that provides readouts of current flow rate, total flow, and system status. The touchscreen can also be used to configure the IRIDIUM settings, adjust set-points and alarms, and troubleshoot errors. The touchscreen can become a digital keypad for simple numeric value entry when needed.

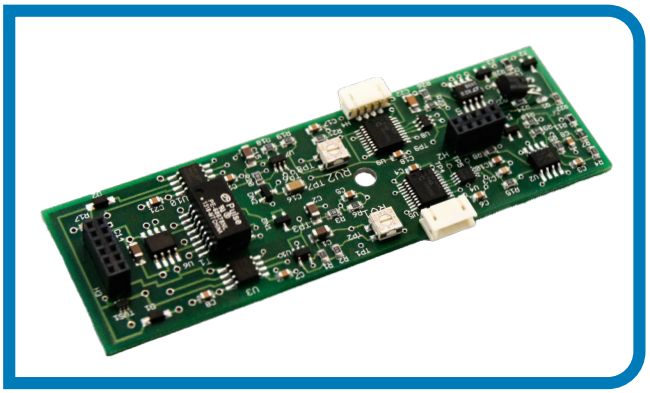
ACTIVE FLOW AND ALARM MONITORING

EASY MENU OPTION NAVIGATION

ON-SITE VALVE SET-POINT ADJUSTMENTS

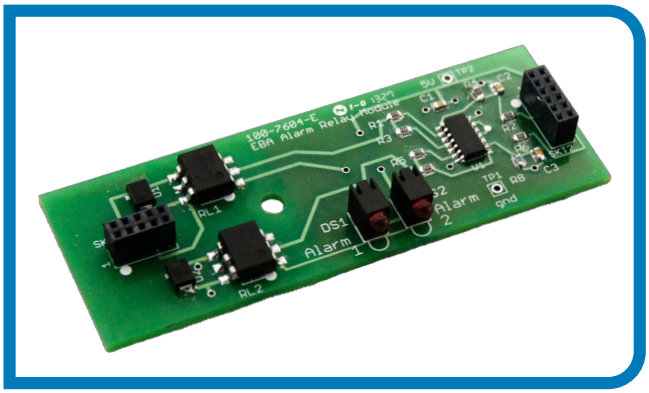
ON-SITE FLOW CALIBRATION OPTIMIZATION

Available Options and Upgrades



ANALOG I/O MODULE (EAA)

Enables the IRIDIUM to receive and transmit analog signals such as 4-20 mA, 0-20 mA, 0-10 VDC, or 0-5 VDC. All signals are fully isolated.



ALARM OUTPUT MODULE (EBA)

Enables the alarms that are built-in to the IRIDIUM to be transmitted externally via solid-state relay contacts.

Available Flow Path Blocks

Currently, McMillan offers one type of inlet/outlet block, one flow sensor block type, and one valve block type.

MALE FLARE INLET/OUTLET BLOCKS (F601)

To facilitate connections to the fluid systems, the F601 inlet and outlet male flare blocks are machined from PTFE and are available in 1/4", 3/8" and 1/2" sizes (examples in Figure 1a). Male flare connections accept flared PFA tubing and require flare nuts to secure (available as accessories).

Male flare to NPT adapters are available to adapt 1/4" male flare connections to 1/8" FNPT (P/N 861-370) and 3/8" male flare connections to 1/4" FNPT (P/N 861-380). These adapters are illustrated in Figure 1b.

Two F601 blocks are required for each working IRIDIUM configuration. The inlet and outlet can be different sizes as required by the application.

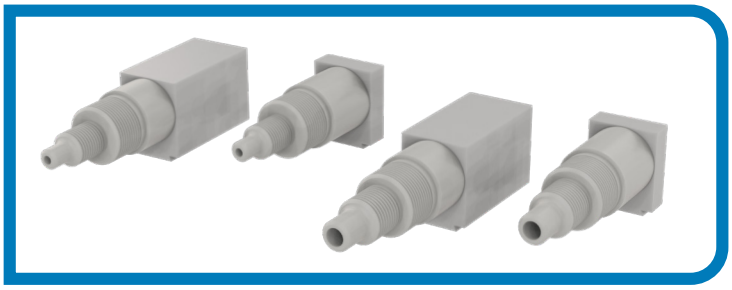


Figure 1a
Representation of male flare inlet/outlet blocks

Figure 1b
Representation of how the 861-370 and 861-380 install on the flare connection

Available Flow Path Blocks

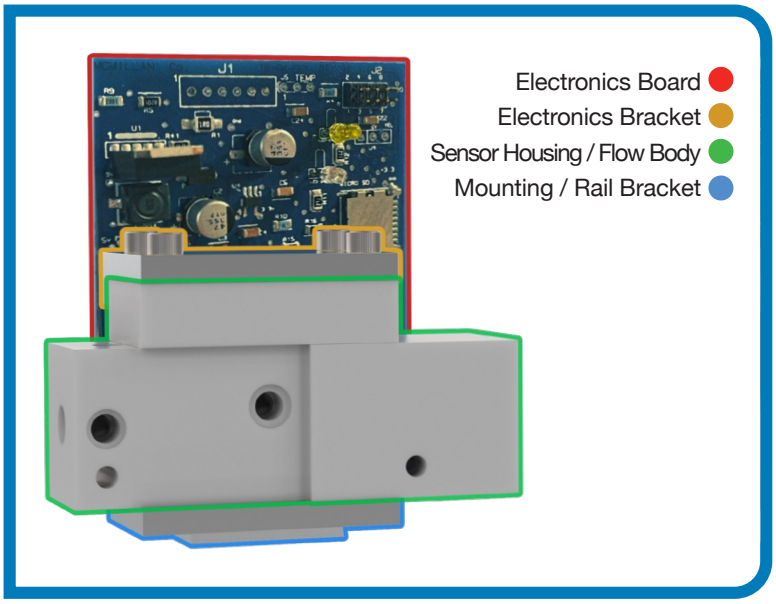


Figure 2a
Sectioned view of Flow Body

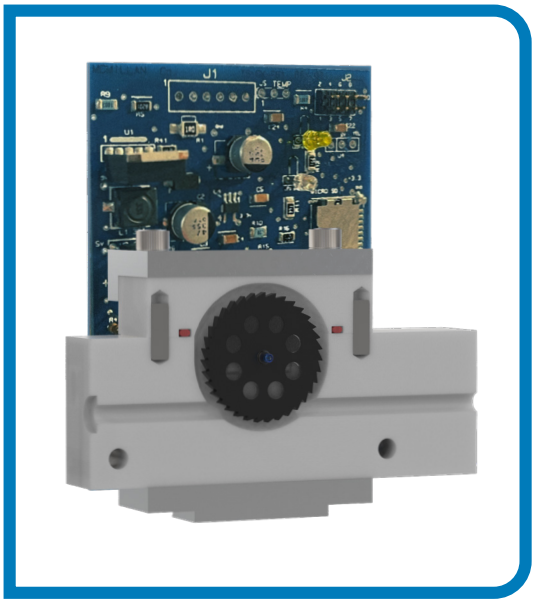


Figure 2b
Cut-away view of Flow Sensor

MICROTURBINE FLOW SENSOR BLOCK (A601)

McMillan's microturbine wheel technology (shown below in Figure 2c) utilizes the Pelton turbine wheel concept. This design allows for the use of a miniature turbine wheel supported by a very small sapphire shaft. The shaft is 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 friction on the shaft and bearings, eliminating wear. As flow passes through the device, it is directed onto the very small teeth of the wheel using a high precision nozzle (see the blue arrows in Figure 2c). 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 integrated translucent round sections. An infrared emitter is located on one side of the wheel and a sensor on the other. As the wheel rotates (as shown with green arrows), the infrared beam (as shown in red) is alternately interrupted and passed through the translucent sections, detecting wheel speed based on flow (as shown with blue arrows). As the wheel spins faster, the pulse rate increases. When the medium flow stops (zero flow conditions), the wheel stops rotating so no pulses are generated. This eliminates the possibility of zero drift and the need for zero adjustments.

This design provides accurate flow measurement with no particle generation, superior to traditional paddle wheel designs. PTFE, perfluoroelastomer options, and sapphire wetted parts ensure compatibility with chemicals commonly found in microelectronics manufacturing processes, including deionized water, CMP slurries, acids, and solvents.

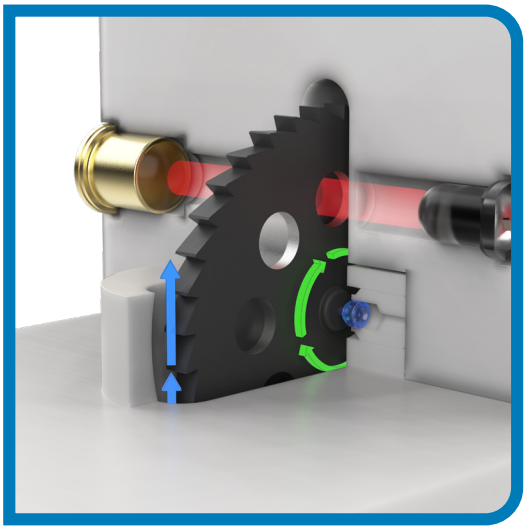


Figure 2c
Sensor operation representation

Available Flow Path Blocks

DIAPHRAGM PROPORTIONAL CONTROL VALVE BLOCK (B601)

To provide responsive control of flow rate, the B601 applies pressure to a large diaphragm that proportionally opens and closes the fluid pathway. This diaphragm is actuated by a precision engineered cam driven perpendicular to the diaphragm with the use of a stepper motor. As the stepper cam extends, it applies more pressure to the diaphragm. See Figure 3 for an illustration of the valve's operation.

In addition to inputs provided by the flow sensor block, the B601 is also able to predictively estimate cam location based on set-point changes. This reduces response time to achieve large changes in flow rate based on large changes in the set-point.

The B601 is designed exclusively for proportional control. It is not designed for a positive shutoff. Contact the factory or an authorized representative for details on using the IRIDIUM to control an external shutoff valve for dispense applications.

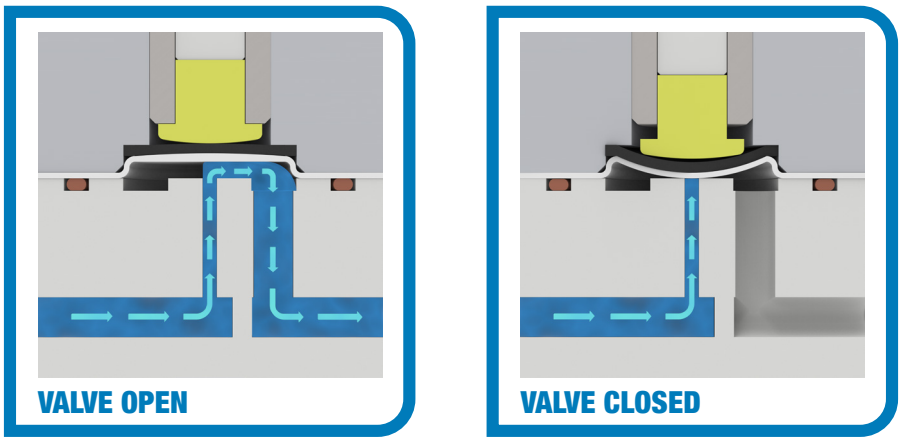
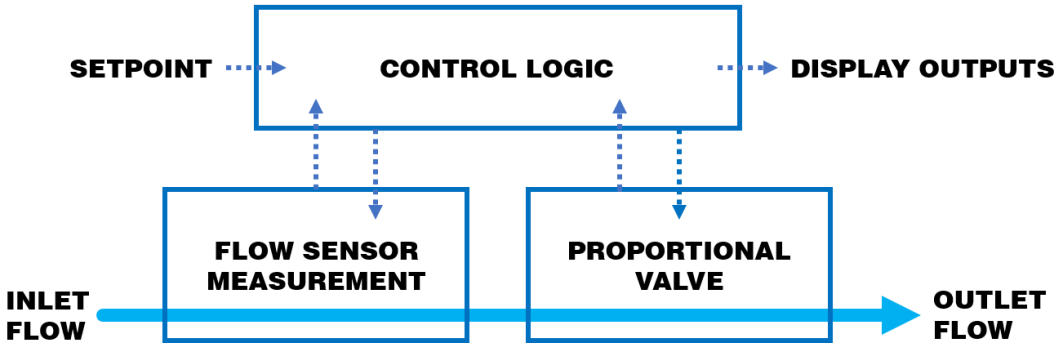


Figure 3
Diaphragm Proportional Control Valve Operation

...HOW DOES A FLOW CONTROLLER WORK?

Flow controllers use an integrated flow rate sensor and control valve to regulate flow rate, regardless of inlet pressure fluctuations. A flow control set-point is provided by the user via the touchscreen, or remotely via an electronic signal. The controller then adjusts the integrated valve as needed to maintain the desired flow rate.



Ordering Information for Factory Configurations

McMillan currently offers various standard factory-built configurations of the IRIDIUM that provide recommended builds using available flow blocks and seal kits.

MICROTURBINE LIQUID FLOW CONTROL (C1)

The C1 configuration uses compatible F601 inlet and outlet male flare fitting blocks, an A601 microturbine flow sensor block, and a B601 valve block for accurate liquid flow control.

Liquid flow ranges as low as 10 – 50 mL/min or as high as 0.5 – 10 L/min are possible. FKM seals are standard; options include upgraded FFKM seals, analog I/O modules, and alarm modules.

FORM PART NUMBER AS FOLLOWS:

6010 - (Package) - C1 - (Flow Range) - (Fittings) - (Options)

6010 – ____ – C1 – ____ – ____ – ____

OPTIONS

- EAA — Analog input/output expansion module, supports 0-10 VDC, 0-20 mA input and output signals
- EBA — Relay output expansion module, 2 solid state relay outputs, configuration functions
- EKZ — Upgrade FKM seals to FFKM

FITTINGS (SEE FITTING AVAILABILITY CHART BELOW FOR AVAILABLE SIZES BASED ON FLOW RANGE)

- F4 — 1/4" male flare
- F6 — 3/8" male flare
- F7 — 1/2" male flare

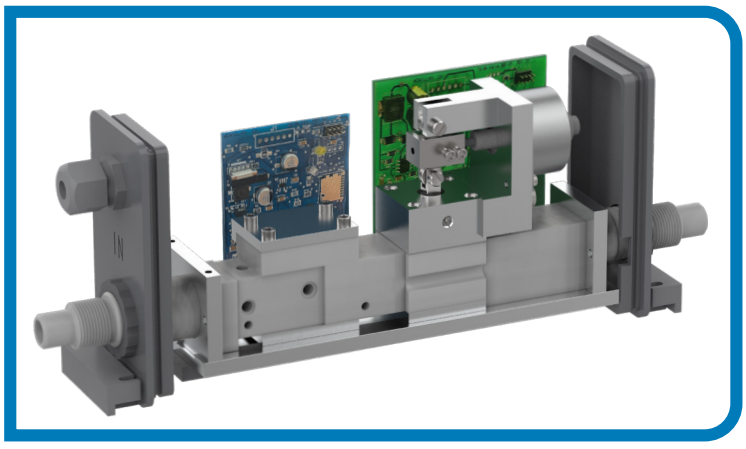
FLOW RANGE

- 2 — 10 – 50 mL/min
- 3 — 13 – 100 mL/min
- 4 — 20 – 200 mL/min
- 5 — 50 – 500 mL/min
- 6 — 100 – 1,000 mL/min
- 7 — 150 – 2,000 mL/min
- 8 — 250 – 5,000 mL/min
- 9 — 0.5 – 10.0 L/min

PACKAGE

- 01 — Integrated Package (all-in-one)
- 02 — Remote Display Package

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



F601 inlet block > A601 flow sensor block > B601 valve block > F601 outlet block

The 6010-02 (remote display package) is supplied standard with a 10 ft remote cable.

Custom length cables between units are available; please contact the factory or an authorized representative for more information.

Specifications

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

IRIDIUM PLATFORM	
ENVIRONMENTAL RATING	Operating Temperature: 32 to 122 °F [0 to 50 °C] Storage Temperature: 32 to 158 °F [0 to 70 °C] Relative Humidity: 20 to 85%
STANDARD I/O INTERFACES	USB 2.0 Micro-A RS485
OPTIONAL I/O INTERFACES	Analog I/O Module [EAA] VDC Input (0-10 VDC or 0-5 VDC, user selectable) 200 Kohm or higher typical input resistance Isolated from power VDC Output (0-10 VDC or 0-5 VDC, user selectable) 5 Kohm or higher acceptable load Isolated from power mA Input (0-20 mA or 4-20 mA, user selectable) Isolated from power mA Output (0-20 mA or 4-20 mA, user selectable) Passive, 500 ohm or lower loop resistance Isolated from power
OPTIONAL RELAY INTERFACES	Alarm Output Module [EBA] 2 relays User configurable menu selections Rating: maximum 0.4 A, 30 VDC
WARM-UP/BOOT TIME	< 10 seconds typical
POWER REQUIREMENT	Recommended Voltage: 24 VDC (16-25 VDC, user selectable) 2.5 watts typical power consumption Reverse polarity and over-voltage protected
ELECTRICAL CONNECTION	15-pin Male D-Sub Micro-USB
DISPLAY (STANDARD)	3.2" [81 mm] TFT LCD color display Resistive touchscreen panel
CERTIFICATIONS	CE Approved; 89 / 336 / EEC (EN 55011 & EN 50082-1) 73 / 23 / EEC Low Voltage Directive UKCA
RATINGS	Integrated Package - IP63 Remote Display Package - Display Side - IP63 Remote Display Package - Meter Side - IP65
WARRANTY	1 year limited

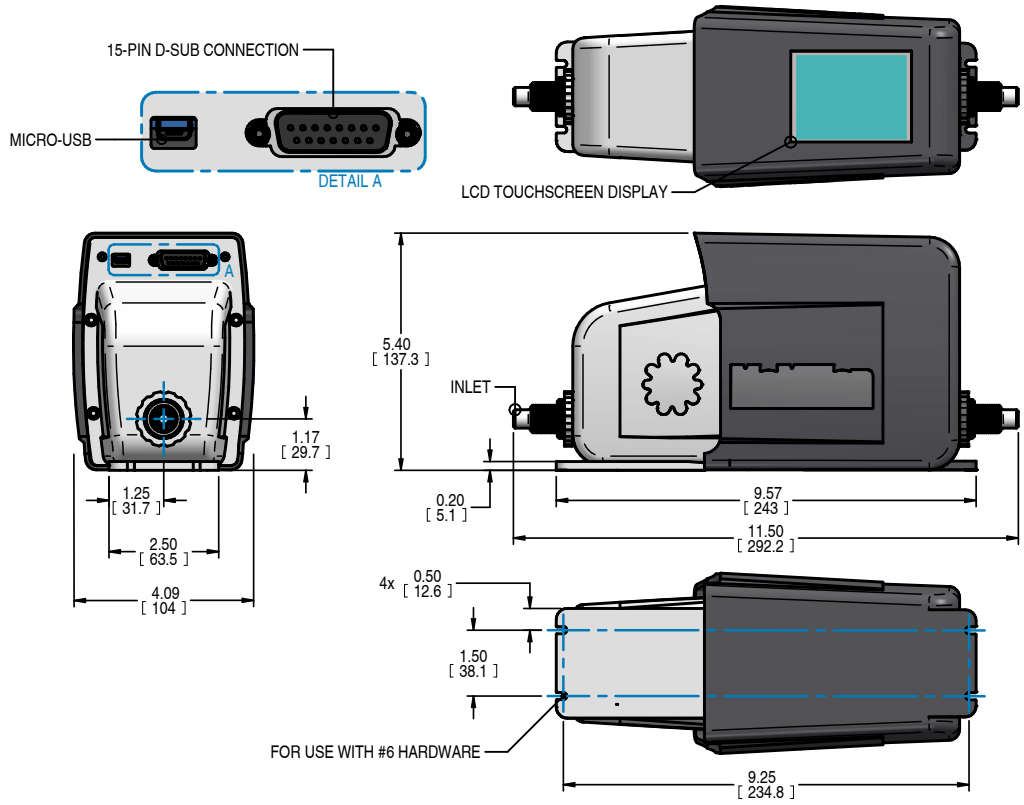
A601 FLOW SENSOR MODULE	
MAXIMUM PRESSURE RATING	80 psig [5.4 barg] burst pressure 60 psig [4.2 barg] max operating pressure
TEMPERATURE RATING (FLUID)	41 to 104 °F [5 to 40 °C] Higher temperature modules may be available
ACCURACY (INCLUDING LINEARITY, BEST FIT STRAIGHT LINE)	± 1.0% typical from factory, full scale ± 0.5% typical with user calibration, full scale
REPEATABILITY	± 0.5% or better typical ± 0.2% best conditions
WETTED MATERIALS	PTFE Sapphire
SEAL MATERIALS	FKM standard FFKM option available [EKZ]
COMPATIBLE FLUIDS	Most low viscosity fluids (< 15 cS) Minimum of entrained air - at low flow ranges
ZERO DRIFT	None

B601 CONTROL VALVE MODULE	
MAXIMUM PRESSURE RATING	80 psig [5.4 barg] burst pressure 60 psig [4.2 barg] max operating pressure
TEMPERATURE RATING (FLUID)	41 to 104 °F [5 to 40 °C] Higher temperature modules may be available
VALVE TYPE	PTFE diaphragm, cam-driven
RESPONSE TIME	Adjustable, typically < 2 seconds to final value
WETTED MATERIALS	PTFE FFKM
SEAL MATERIALS	FKM standard FFKM option available [EKZ]
DIFFERENTIAL PRESSURE TYPICAL CONFIGURATION	20 psid [1.4 bar] to reach 100% rated flow Minimum 5 psid [0.3 bar] to reach 50% rated flow Not to exceed 50 psid [3.4 bar] *Other differential pressure configurations available

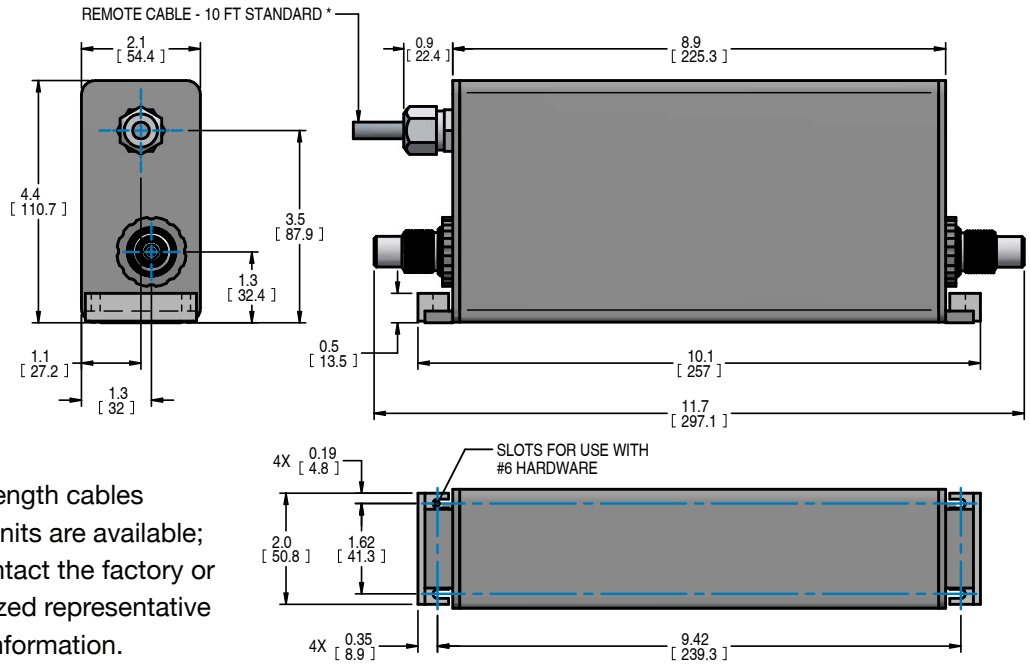
Dimensions

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.

INTEGRATED PACKAGE:



REMOTE DISPLAY PACKAGE (METER SIDE)*:



*Custom length cables between units are available; please contact the factory or an authorized representative for more information.

Dimensions

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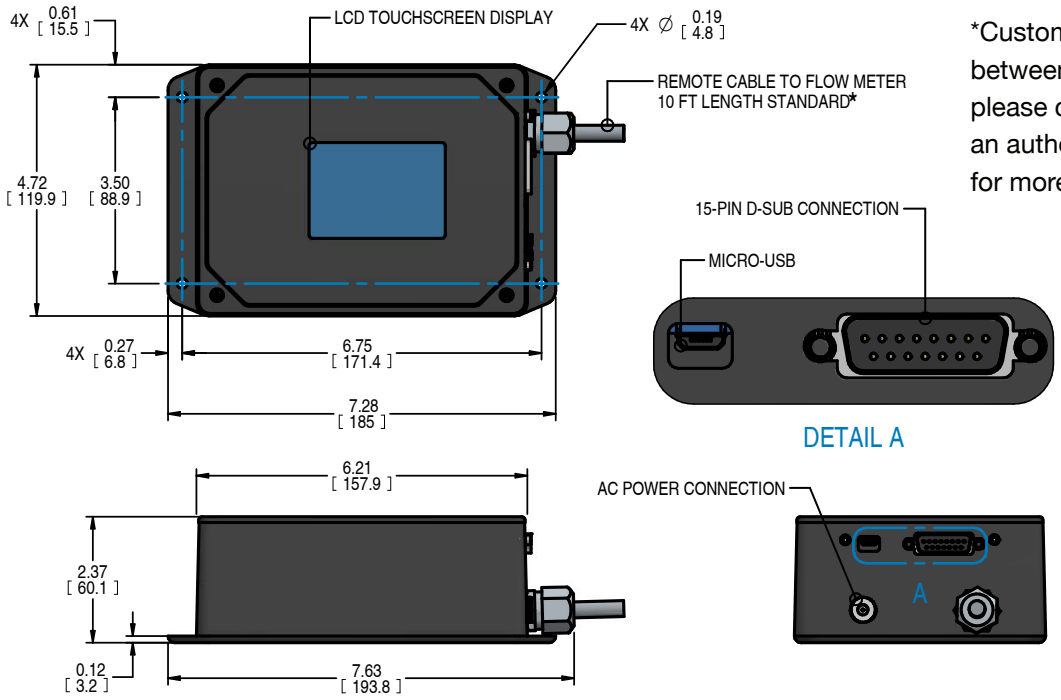
All dimensions shown in inches [mm] unless otherwise noted.

REMOTE DISPLAY PACKAGE (DISPLAY SIDE):



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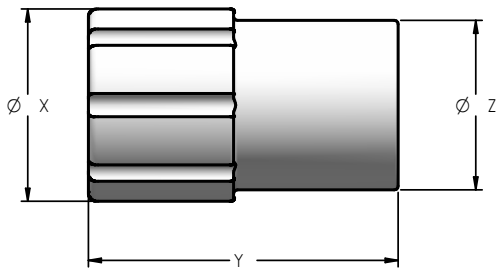
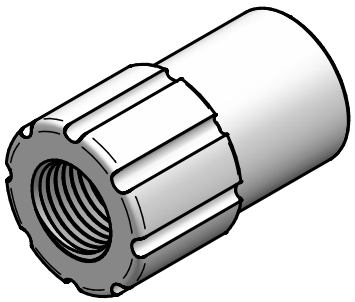
NPT ADAPTER:





NPT ADAPTER DIMENSIONS			
PART #	X	Y	Z
861-370	1.0 [25.4]	1.6 [40.6]	0.9 [22.4]
861-380	1.3 [31.8]	1.8 [45.7]	1.0 [25.4]

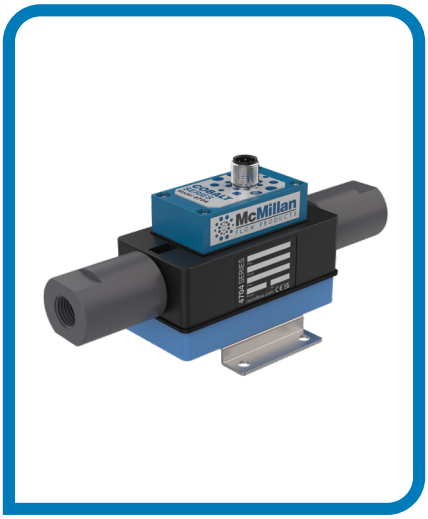
Related Accessories

CODE	DESCRIPTION
861-300	6 ft [2m] DB15 extension cable (M-F)
861-301	10 ft [3m] DB15 extension cable (M-F)
861-310	Female DB15 connector block kit (for easy wiring)
861-304	6 ft [2m] Micro USB cable kit
861-320	Tabletop tilt stand (6010-01 only)
861-305	115-230 VAC Power supply for 6010-02
861-360	Power supply kit, includes 6 ft [2m] cable, power supply and block kit for 6010-01
861-370	HDPE & Viton 1/4” male flare to 1/8” FNPT (each)
861-380	HDPE & Viton 3/8” male flare to 1/4” FNPT (each)

Related Products

RHODIUM Series Meters

MEMS-Based flow controllers for gases



COBALT Series Meters

Electromagnetic flow meters for conductive liquids

10X Series Flow Sensors

Microturbine flow sensors for liquids and gases

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