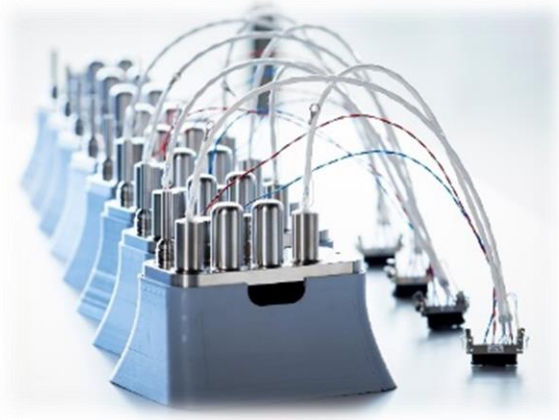
High-Pressure Flow Control Unit (HP-FCU)

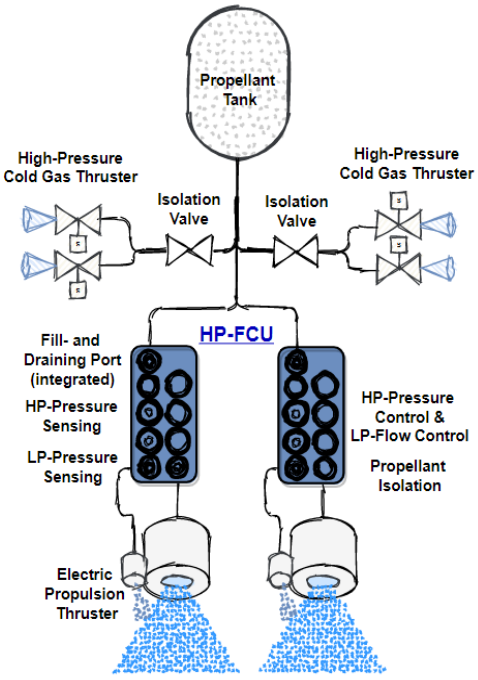
AST's High-Pressure Flow Controller (HP-FCU) is designed to provide a constant mass flow to one or two devices in the low-pressure section. The HP-FCU combines the functions of a two-stage pressure regulator and flow controller in one unit, offering a compact and efficient solution. The high pressure at the unit inlet is measured and reduced by controlled expansion in two steps to intermediate pressures, and precision mass flow limiters are used to control the mass flow.





The unit is capable of controlling one or two output mass flows, while the two flow lines will be served with a fixed mass flow splitting. Typically, a fixed operation point (e.g. one fixed mass flow setting) is selected for the HP-FCU but a variation of mass flows around the design point is possible by different operation parameter settings (e.g., in-orbit).

The stainless-steel HP-FCU is an all-welded design, offering enhanced robustness against rupture and propellant loss. All high-pressure joints are manufactured by electron-beam welding and each unit undergoes proof-pressure and leakage testing prior to shipment. Inlet and outlet filters protect the unit during handling and integration.



Customers have the option of selecting from a wide range of configuration options, allowing them to choose the best fit for their specific operational and interface needs. AST proposes a set of generic acceptance tests, with the option of adding specific verifications to meet the customer's needs.

The HP-FCU's integrated functions streamline the fluidic architecture of an EP subsystem, offering a convenient solution for system designers. Typically, the HP-FCU is used in a single- or dual-thruster configuration with one operation mode. The HP-FCU's compact design offers significant benefits for fluidic systems. It can also be equipped with a Fill-and-Drain Valve for direct filling of the propellant tank.

The HP-FCU design is fully qualified for use with Xenon and has extensive flight heritage. The configuration operating at higher pressures (e.g. for Krypton) is currently under qualification.

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HP-FCU - Characteristics

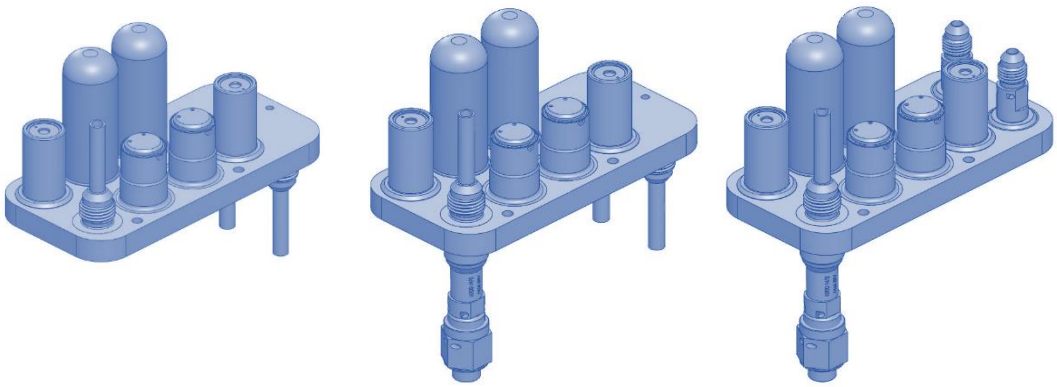
Parameter	*Value*	*Remark*
Operating Media	*Xe, Kr*	*Xe heritage, Kr qualified*
Inlet Pressure MEOP	*320 bar*	*Xe operation up to 186 bar qualified*
Inlet Pressure EOL	*2 bar*	*flow dependent*
Proof Pressure	*1.5 x MEOP*	*design value > 480 bar*
Low Pressure Lines MEOP	*1 or 4 bar*	*depending on LP sensor selection*
Low Pressure Lines Proof Pressure	*7 bar*	*limited by LP sensor*
Burst Pressure	*>2.5 x MEOP*	*design value > 800 bar*
Nominal Anode Flow	*0.6 mg/s to 10 mg/s*	*selectable by design; depends on gas*
Nominal Cathode Flow	*e.g. 10% of anode flow*	*selectable by design; depends on gas*
Throttle Range	*-25% to +50%*	*settable during operation*
Regulation Precision	*better than 1%*	*depending on electronics and control loop*
Output Flow Ripple	*< +/-2.5%*	*depending on electronics bandwidth and line volume*
Flow Response Time	*up <5 s* *down <20s*	*to achieve 95% of a full scale step at line outlet port (e.g. during start up).*
Internal Leakage	*< 1*10-5 sccs GHe*	*verified during acceptance tests*
External Leakage	*< 1*10-6 sccs GHe*	*verified during acceptance tests*
Thermal Range non-op	*-20°C to +80°C*	*incl. qualification margin*
Thermal Range op	*+25°C to +65°C*	*full performance*
Thermal Range op (cold start)	*-10°C to +65°C*	*limited performance (heater recommended)*
Fluid Filtration Rate	*11µm*	*5µm mesh at inlet and outlet*
Mass	*< 900 g*	*w/o harness, varying with configuration*
Average Power Consumption	*<10 W*	*depending on valve actuation frequency*
Valve Operating Voltage	*24V to 32V*	*min pull-in voltage required for motorization margin; 50% hold-voltage*
Pressure Sensor Excitation Volage	*10V*	*in sensor voltage excitation mode*
Vibration Qualification Levels	*26.9 gRMS*	*all 3 axis*
Shock Qualification Loads	*2000g*	*At frequencies higher than 1000Hz*
Radiation Tolerance	*Up to 8 Mrad*	*Total Ionizing Dose (TID)*

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HP-FCU - Customization Options

Configuration Discriminators	AST HP-FCU 2.0 - Customization Options			
Inlet / Tank Port Type	Straight Tube Stub			
Inlet / Tank Port Position	Top Surface of FPB	Bottom Surface of FPB		
Fill- and Drain Valve	No FDV	on opposite side of Inlet/tank port		
Number of Outlet Ports	One Outlet Port	Two Outlet Ports		
Outlet Port Type	Straight Tube Stub	AN-Interface	VCR-Interface	
Outlet Port Position	Top Surface of FPB	Bottom Surface of FPB		
LP-Sensor Pressure Range	4 bar	1 bar		
Thermistors	None	One	Two	Three
Heater	None	Surface Heater		
Outlet Port 1 nominal massflow	None	..... mg/s		
Outlet Port 2 nominal massflow	None	..... mg/s		

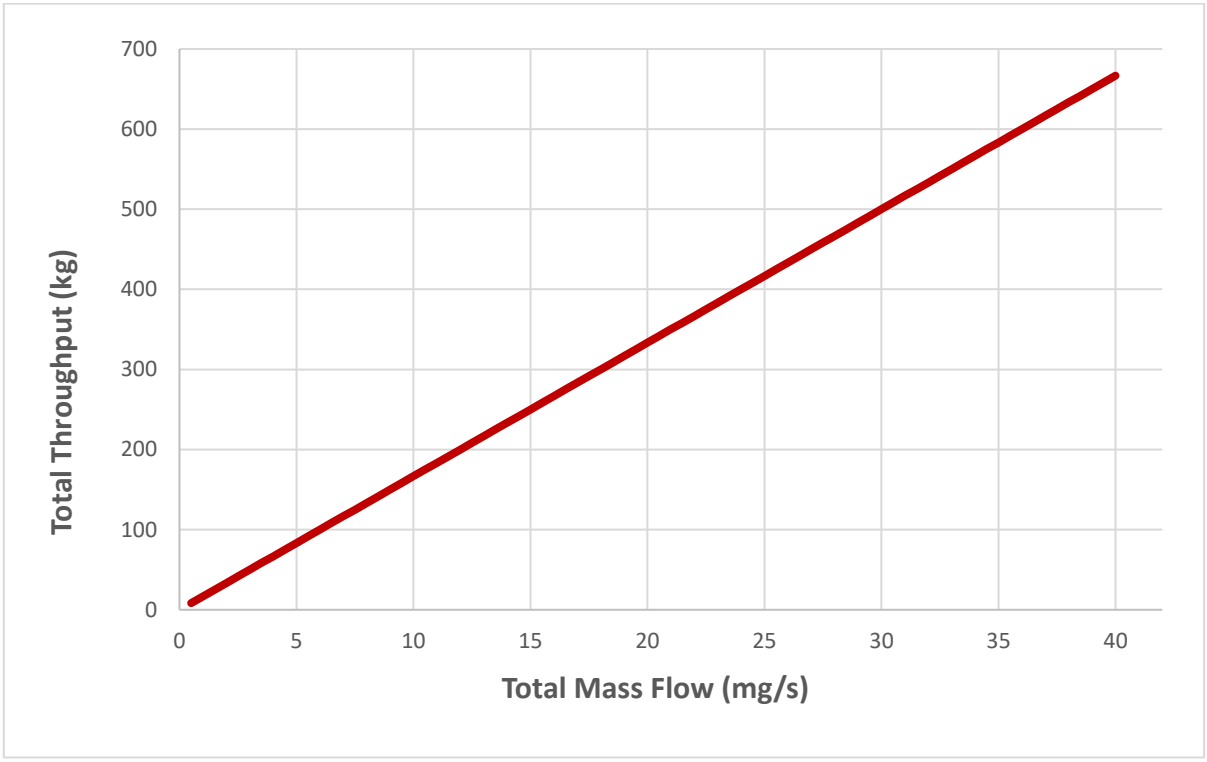
The Configuration Map above shows options that can be selected for each individual configuration. Below see some example configurations of the HP-FCU.



The HP-FCU characteristics and Configuration Map are subject to changes. Please contact AST for details and requests for further options.

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The table below shows the correlation between Total Mass flow and Throughput



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