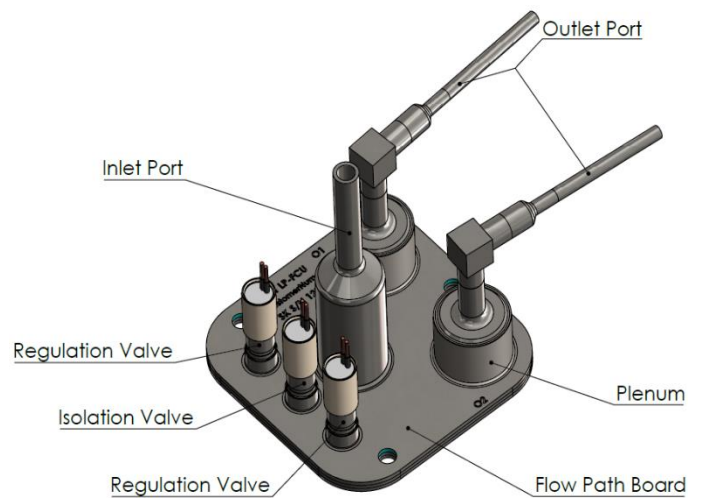


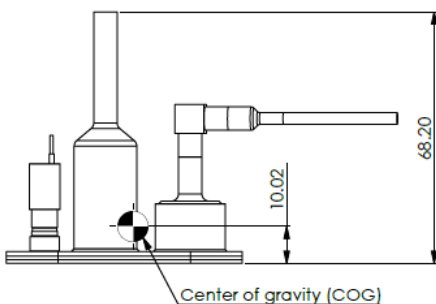
Low-Pressure Flow Control Unit (LP-FCU)

The low pressure FCU is a compact open-loop flow control unit, which is fed by an upstream pressure regulator with a regulated inlet pressure in the range of 1.0 bar to 4.0 bar. In non-operating mode, the FCU provides double barrier for propellant isolation. In operating mode, it supplies a massflow at a regulated flow rate to the thruster and the corresponding neutralizer. Inlet and outlets of the FCU are protected by particle filters.

All components are fluidically interconnected through the Flow Path Board (FPB) which is a stainless-steel element with integrated flow channels. They are welded by electron beam into the FPB. This design is a key feature as it significantly reduces complexity and improves robustness of the unit in-orbit.

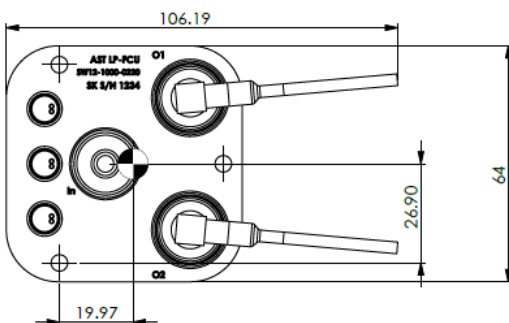


Inlet and outlet ports are equipped with filter mesh to assure function of the valves after ground handling.



The flow rate is controlled by actuation of the FCU valves. During operation the common isolation valve is held open permanently. The flow resistor in each of both flow lines converts the (common) inlet pressure into an (average) flow rate which can be controlled individually for each flow line by actuating the corresponding regulation valve in a pulse width modulation scheme at a typical frequency of 1 to 5 Hz.

The throttling range of both flow lines can be 1-to-10 depending on the chosen nominal massflow. That allows for a very wide range of operational flows with the very same hardware in orbit.



The LP-FCU can be equipped with foil-heaters on the downside of the FPB in order to maintain constant temperature conditions. With the very low power consumption of the LP-valves, dissipation on the unit is below 2W. The unit is mounted to a structure through three M4 screws with thermal washers compatible to the satellite thermal control system.

LP-FCU- Characteristics

<i>Parameter</i>	<i>Value</i>	<i>Remark</i>
<i>Operating Media</i>	<i>Xe, Kr, Ar, ...</i>	<i>Xe in qualification</i>
<i>Inlet Pressure MEOP</i>	<i>5 bar</i>	<i>max operation</i>
<i>Inlet Pressure EOL</i>	<i>1 bar</i>	<i>flow dependent</i>
<i>Proof Pressure</i>	<i>1.5 x MEOP</i>	<i>design value > 7,5 bar</i>
<i>Burst Pressure</i>	<i>>2.5 x MEOP</i>	<i>design value > 12,5 bar</i>
<i>Nominal Anode & Cathode Flow</i>	<i>0.1mg to 10 mg/s</i>	<i>selectable by design;</i>
<i>Throttle Range</i>	<i>better 1 to 10</i>	<i>settable during operation</i>
<i>Propellant Throughput Capability</i>	<i>>100 kg</i>	<i>depends on flow level</i>
<i>Regulation Precision</i>	<i>better 1%</i>	<i>depending on electronics and control loop</i>
<i>Output Flow Ripple</i>	<i>< +/-2.5%</i>	<i>depending on electronics bandwidth and line volume</i>
<i>Flow Response Time</i>	<i>up <10 s down <30s</i>	<i>to achieve 95% of a full scale step at line outlet port (e.g. during start up).</i>
<i>Internal Leakage</i>	<i>< 1*10⁻⁵ sccs GHe</i>	<i>verified during acceptance tests</i>
<i>External Leakage</i>	<i>< 1*10⁻⁷ sccs GHe</i>	<i>verified during acceptance tests</i>
<i>Thermal Range non-op</i>	<i>-20°C to +95°C</i>	<i>incl. qualification margin</i>
<i>Thermal Range op</i>	<i>+40°C to +50°C</i>	<i>full performance</i>
<i>Thermal Range op (cold start)</i>	<i>-10°C to +65°C</i>	<i>limited performance (heater recommended)</i>
<i>Fluid Filtration Rate</i>	<i>11µm</i>	<i>5µm mesh at inlet and outlet</i>
<i>Mass</i>	<i>< 200 g</i>	<i>w/o harness, incl. margin</i>
<i>Average Power Consumption</i>	<i>< 2 W</i>	<i>depending on valve actuation frequency</i>
<i>Valve Operating Voltage</i>	<i>24V</i>	<i>min pull-in voltage required for motorization margin; 50% hold-voltage</i>
<i>Vibration Qualification Levels</i>	<i>20 gRMS</i>	<i>all 3 axis</i>
<i>Shock Qualification Loads</i>	<i>3000g</i>	<i>At frequencies higher than 1000Hz</i>
<i>Radiation Tolerance</i>	<i>10 Mrad</i>	<i>Total Ionizing Dose (TID)</i>