



# PROPULSION UNIT FOR CUBESATS

(PUC-SO2)

JULY 2018

The CU Aerospace (CUA) / VACCO Propulsion Unit for CubeSats (PUC) is a complete high-performance and compact small-satellite propulsion solution. The all-welded titanium PUC comes fully integrated with all necessary propulsion subsystems, including controller, power processing unit, micro-cavity discharge thruster, propellant valves, heaters, sensors, and software. PUC is software-configurable to operate over a wide range of power, thrust, and impulse levels. System set-points, system status, and firing telemetry are all accessible and configurable through an RS422 serial interface.

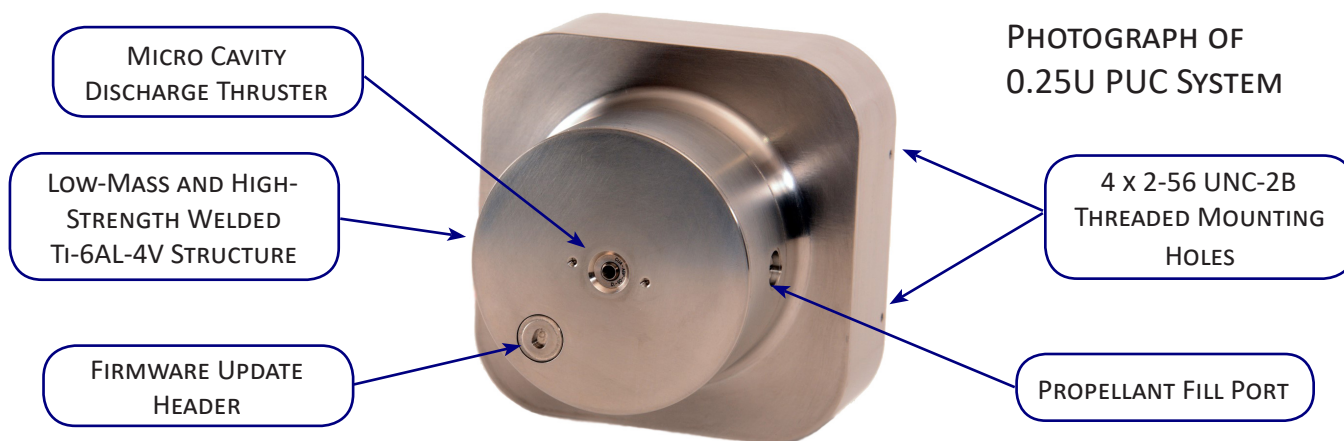
The baseline 0.25U system fits within a compact 350 cm<sup>3</sup> volume (0.25U + “hockey puck”), providing outstanding performance for minimal CubeSat volume and mass fraction. PUC achieves its high total impulse to volume ratio by employing CUA Micro-Cavity Discharge (MCD) propellant heating technology, high-density and self-pressurizing liquid propellants, and an optimized low mass flow nozzle. For increased performance, the tank width and length may be customized to meet customer specific mission requirements, providing significant potential for increased propellant capacity, i.e. delta-V capability.

## FEATURES:

## PUC FAMILY PERFORMANCE:

UNIT SIZE	0.25U	0.5U*	1U*
Nominal thrust [mN]	5		
Warm-fire specific impulse [sec]	70		
Total impulse potential [N-s]	184	320	593
Delta-V potential (3 kg CubeSat) [m/s]	64	116	233
Delta-V potential (4 kg CubeSat) [m/s]	48	85	167
Minimum impulse bit [mN-s]	1.0		
Nominal wet mass [grams]	718	980	1500

\*Performance estimated based on 0.25U ground testing of flight-quality units.



- Two operational modes:
  - Warm gas: high specific impulse (15 Watt nominal)
  - Cold gas: minimum or small impulse (8 Watt nominal)
- On-orbit update of system parameters, including:
  - Thrust duration
  - Plenum pressure (i.e. thrust)
  - MCD power level (i.e. specific impulse)
  - Temperature & fault set-points
- Telemetry and status packets for system monitoring
- Dedicated propellant heater for continuous operation below +5°C ambient temperature
- Propellant vaporizer for ensuring 100% vapor delivery
- Voltage and current sensors for closed-loop MCD power regulation, monitoring, troubleshooting, and protection
- Reliable, frictionless VACCO valve technology:
  - Valves tested to 75,000+ cold gas firings
  - System one-failure-tolerant against leakage
- Life span: 2 years from propellant load
- High-density & self-pressurizing sulfur dioxide propellant:
  - Non-flammable, chemically stable, high critical temperature, low freezing point, & low vapor pressure
  - Commonly used refrigerant prior to freons

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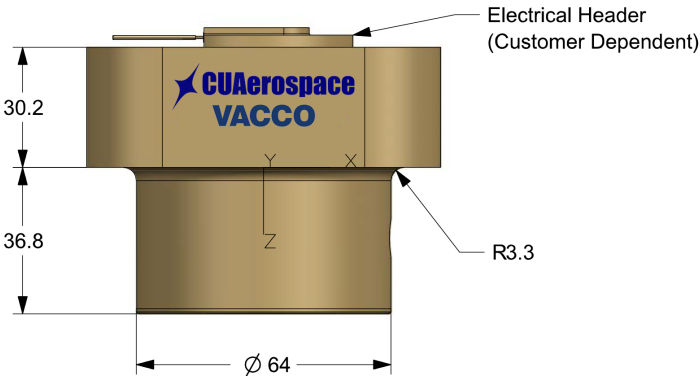
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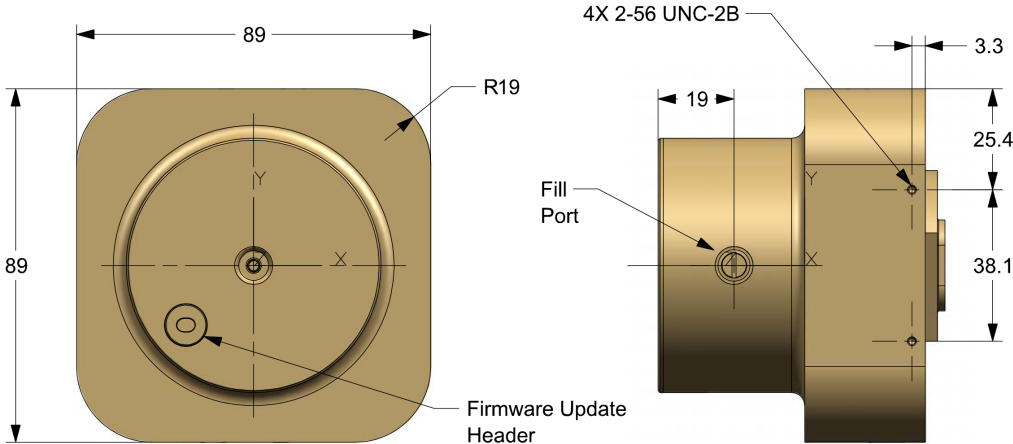
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PUC ENVELOPE

UNITS: [mm]

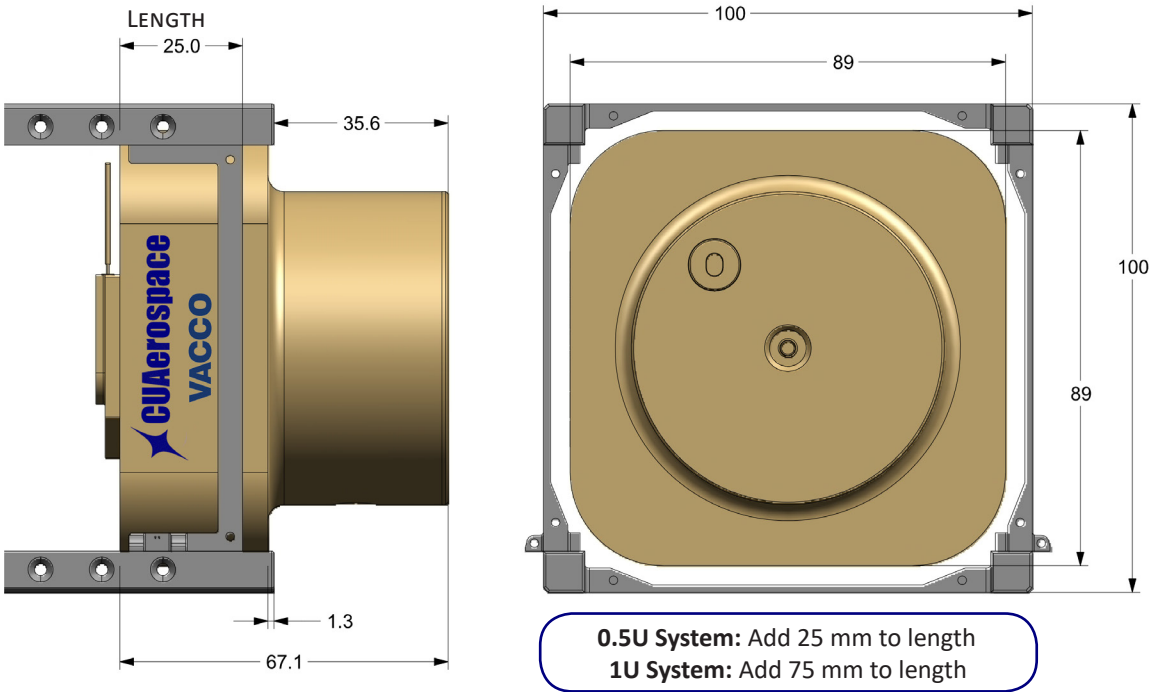


CENTER OF GRAVITY EST. (0.25U GEOMETRY)		
	DRY [mm]	WET [mm]
X	1.2	0.6
Y	0.9	0.5
Z	-1.6	-4.8



FIT TO EXAMPLE CUBESAT FRAME

UNITS: [mm]



PUC is engineered and manufactured through a partnership between CUA and VACCO Industries.