

ENPULSION  
**MICRO R<sup>3</sup>**

Building on the heritage of the ENPULSION NANO, ENPULSION is developing a scaled version of the technology to target **small and medium size spacecrafts**. The ENPULSION MICRO R<sup>3</sup> is engineered in a modular approach, with units clustering easily together to form building blocks that can be arranged for various mission profiles.

**The first model was successfully operated in space in Q1 2021.**



**MATURE TECHNOLOGY**

The ENPULSION MICRO R<sup>3</sup> is a scaled technology of the ENPULSION NANO with a developmental history of over 15 years. During this time, there have been hundreds of emitters tested with an ongoing lifetime test that has surpassed 30,000 hours of firing. This endurance test continues without degradations.



**MODULAR PACKAGE WITH HIGH TOTAL IMPULSE**

One module and its tank only take up a volume of 1.6 L and can provide more than 50,000 Ns at 4,000 s I<sub>sp</sub>. The module is simply bolted to the outside of the spacecraft and can be used as a standalone unit or easily be clustered for higher thrust applications.



**DYNAMIC PRECISE THRUST CONTROL**

Thrust can be controlled through the electrode voltage, which provides excellent controllability, down to a precision of 50 μN with low thrust noise.



**DEBRIS SAFETY**

Even during active operation, no part of the thruster is pressurized, and no chemical energy is stored. This means that in case of a collision or impact, there will not be an explosive reaction which could harm the spacecraft and create debris.



**CONTROLLABLE SPECIFIC IMPULSE UP TO 4,500 S**

With its efficient ionization process the ENPULSION MICRO R<sup>3</sup> can deliver higher specific impulse than any other ion propulsion system currently on the market. The thruster is capable of a range of I<sub>sp</sub> from 1,000 s to 4,500 s.



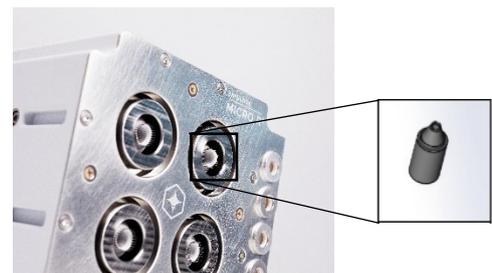
**HERITAGE ELECTRONICS**

The Power Processing Unit is based on the heritage electronics used in the ENPULSION NANO, leveraging exhaustive on-orbit and testing heritage, as well as introducing component lot control and heritage in EEE part selection. The PPU can be either stacked or integrated separately from the thruster



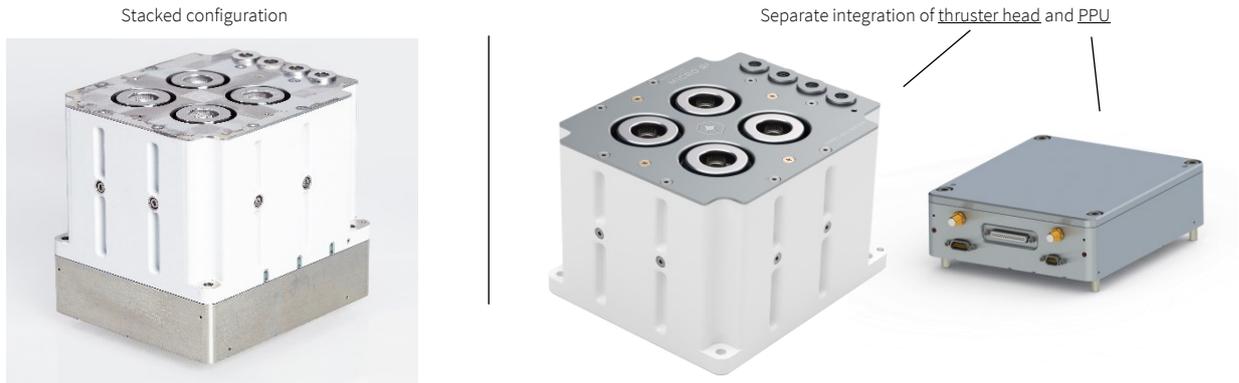
**SAFE AND INERT SYSTEM COMPLIANT DURING LAUNCH**

The FEEP technology contains no moving parts and uses non-toxic indium as propellant. There are neither liquids or reactive propellants nor pressurized vessels. Stored as a solid and filled at our factory it requires no special handling, integration, or launch procedures.



4 Emitters, reservoir for 1.3 kg of indium in a 14x12x10 cm envelope

Each emitter is identical to used in the ongoing lifetime test (>30,000 h)



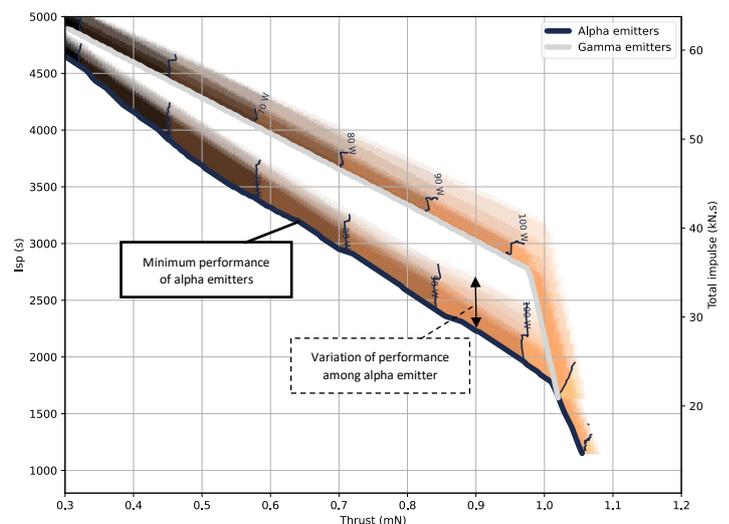
The ENPULSION MICRO R<sup>3</sup> can be integrated in a stacked configuration, with the PPU situated directly underneath the thruster head, with same footprint. Alternatively, the PPU box can be integrated separately from the thruster head.

### PROPERTIES AND PERFORMANCE

Since the founding of the company in 2016 we have delivered to customers hundreds of thrusters, more than 100 of which are currently in space. We have therefore developed an empirical understanding of the intrinsic variation of the performance and parameters of emitters in these thrusters in their production process and in their application in different types of missions. This enables us, starting from January 1st 2022, to offer you our new Emitter Selection Service which allows you to select between three distinct types of crown emitters.

- **Alpha (α)** emitters provide the best balance between price, performance, and guaranteed delivery times. This is the perfect solution for commercial constellation applications.
- **Beta (β)** emitters are the best solution whenever cost optimization is your most important driver.
- **Gamma (γ)** emitters are hand-picked for their guaranteed peak performance and are especially appropriate for your missions in deep space, exploration, and others where emitter output needs to be taken to extremes.

MICRO R <sup>3</sup>	
DYNAMIC THRUST RANGE <sup>1</sup>	300 μN - 1 mN
NOMINAL THRUST	1 mN
SPECIFIC IMPULSE	1,500 - 4,500 s
PROPELLANT MASS	1.3 kg
TOTAL IMPULSE <sup>2</sup>	Up to 50 kNs
TOTAL SYSTEM POWER	30 - 120 W
POWER AT NOMINAL THRUST	105 W
OUTSIDE DIMENSIONS	
Thruster head	140 x 120 x 98.6 mm
PPU box	140 x 120 x 34.0 mm
MASS (DRY / WET) including PPU	2.6 kg / 3.9 kg
HOT STANDBY POWER <sup>3</sup>	10 - 15 W



<sup>1</sup> The ENPULSION MICRO R3 can be operated at a wide range of thrust and specific impulse, depending on the power level available. The operational envelope is based on total system power including typical heater and neutralizers consumption. Performances shown above correspond to maximum thrust to power curves for different grades of emitters.

<sup>2</sup> Strongly dependent on emitter option. See performance map for selection options.

<sup>3</sup> Dependent on accommodation and resulting thermal environment