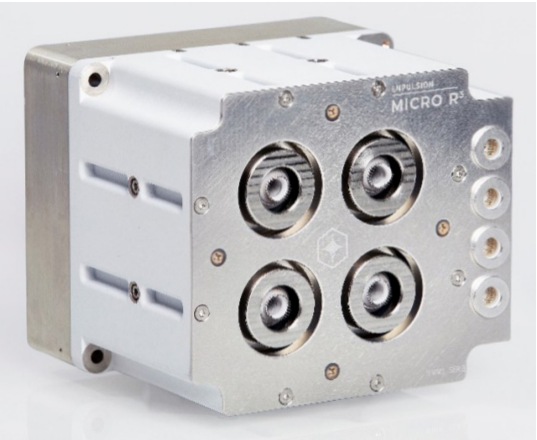
ENPULSION

MICRO R³

FEEP | FIELD EMISSION
ELECTRIC PROPULSION

as of JAN 2024

Building on the heritage of the ENPULSION NANO, ENPULSION has developed a scaled version of the technology to target *small and medium-sized spacecraft.* The **ENPULSION MICRO R³** 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 R³ 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.

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_{sp}. 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 300 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 R³ can deliver higher specific impulse than any other ion propulsion system currently on the market. The thruster is capable of a range of Isp from 1,500 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.

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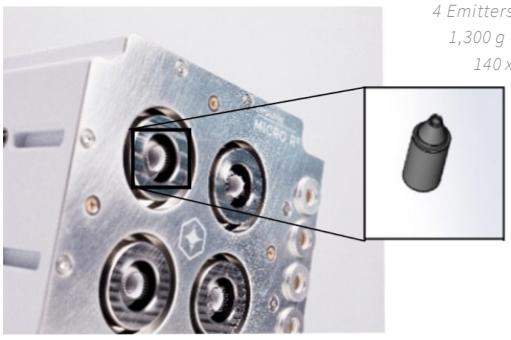
SAFE AND INERT SYSTEM COMPLIANT DURING LAUNCH

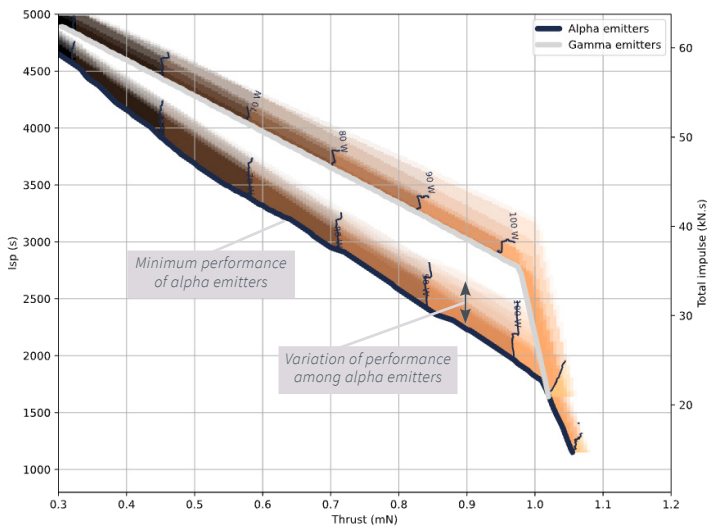
The FEEP technology contains no moving parts and uses non-toxic indium as propellant. There are neither liquids or reactive propellants nor pressurized vessels. Stored as a solid and filled at our factory it requires no special handling, integration, or launch procedures.



4 Emitters, reservoir for 1,300 g of indium in a 140 x 120 x 100 mm envelope.

STACKED CONFIGURATION

The ENPULSION MICRO R³ is a fully integrated propulsion system in a stacked configuration, with the PPU situated directly underneath the thruster head, with same footprint.



DYNAMIC THRUST RANGE:[1]	300 µN – 1 mN
NOMINAL THRUST:	1 mN
SPECIFIC IMPULSE:	1,500 – 4,500 s
PROPELLANT MASS:	1.3 kg
TOTAL IMPULSE:[2]	UP TO 50 kNs
POWER AT NOMINAL THRUST:	105 W
MASS (DRY/WET):	2.6 kg (DRY) INCL. PPU
	3.9 kg (WET) INCL. PPU
TOTAL SYSTEM POWER:	30 – 120 W
HOT STANDBY POWER:[3]	10 – 15 W
OUTSIDE DIMENSIONS:	
THRUSTER HEAD	140 × 120 × 98.6 mm
PPU BOX	140 × 120 × 34.0 mm

EMITTER SELECTION SERVICE

Since the company was founded in 2016 we have delivered hundreds of thrusters to customers worldwide, close to 200 of which are currently in space. Therefore we have 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, to offer our customers our new Emitter Selection Service which allows you to select between two distinct types of crown emitters:

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

1 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.

2 Strongly depends on emitter option. See performance map for selection options.

3 Depends on accommodation and resulting thermal environment.