IFM NANO THRUSTER

For 15 years, FOTEC has followed a technology push from ESA developing a FEEP propulsion technology for a precise orbit control of scientific satellites in formation flight. This very mature and worldwide unique technology is meeting a strong need in an emerging market of satellite constellations (hundreds of small satellites performing a task together). ENPULSION has been founded as a Spin-Out together with FOTEC to meet this market demand by preparing to scale the production of this thruster to several hundred units per year.

**FLIGHT HERITAGE**
The IFM Nano Thruster was successfully tested in orbit on a customer spacecraft in early 2018, performing independently confirmed orbit changes.

**MATURE TECHNOLOGY**
The IFM Nano Thruster is a mature technology, developed under ESA contracts for 15 years. In this time more than 100 emitter have been tested and an ongoing lifetime test has demonstrated more than 20,000 h of firing without degradation of the emitter performance.

**SAFE AND INERT SYSTEM COMPLIANT DURING LAUNCH**
The IFM Nano Thruster contains no moving parts and the propellant is in its solid state at room temperature. Avoiding any liquid and reactive propellants as well as pressurized tanks significantly simplifies handling, integration and launch procedures.

**COMPACT BUILDING BLOCKS**
The IFM Nano Thruster module is used as a compact pre-qualified building block in order to provide custom solutions at a commodity price and ultra-short lead times. Although building blocks are completely self-contained propulsion systems, the whole cluster can be operated as a single plug-and-play unit.

**DYNAMIC PRECISE THRUST CONTROL**
The thrust can be controlled through the electrode voltages, providing excellent controllability over the full thrust range and a low thrust noise.

**CONTROLLABLE SPECIFIC IMPULSE UP TO 6,000 S**
Due to the efficient ionization process, which allows the capacity to ionize up to 60% of the evaporated indium atoms, the IFM Nano Thruster can provide a higher specific impulse than any other ion propulsion system currently on the market.

**REDUNDANT NEUTRALIZER CATHODES**
As the IFM Nano Thruster expels an ion current of up to 4 mA, the module needs means to prevent spacecraft charging. This is achieved by the use of two cold-redundant electron sources acting as neutralizers. Once electrons have left the neutralizer, they will be pulled towards the positive potential of the ion plume. The PPU is able to measure and control this charge balancing electron current.
PROPERTIES AND PERFORMANCE

While the required power to operate the IFM Nano Thruster starts at around 8 W, at higher thrust levels one can choose between high thrust and high specific impulse operation. The IFM Nano Thruster can operate at an Isp range of 2,000 to 6,000 s. At any given thrust point, higher Isp operation will increase the total impulse, while it will also increase the power demand. The thruster can be operated along the full dynamic range throughout the mission. This means that high Isp and low Isp maneuvers can be included in a mission planning, as well as high thrust orbit maneuver and low thrust precision control maneuvers.

DYNAMIC THRUST RANGE  
10 µN TO 0.4 mN

NOMINAL THRUST  
350 µN

SPECIFIC impulse  
2,000 TO 6,000 s

PROPELLANT MASS  
230 g

TOTAL impulse  
MORE THAN 5,000 Ns

POWER AT NOMINAL THRUST  
40 W INCL. NEUTRALIZER

OUTSIDE DIMENSIONS  
100.0 x 100.0 x 82.5 mm

MASS (DRY / WET)  
670 / 900 g

TOTAL SYSTEM POWER  
8 – 40 W

HOT STANDBY POWER  
3.5 W

COMMAND INTERFACE  
RS422/RS485

TEMPERATURE ENVELOPE  
-40 TO 105°C (NON-OPERATIONAL)

TEMPERATURE ENVELOPE  
-20 TO 40 °C (OPERATIONAL)

SUPPLY VOLTAGE  
12 V, 28 V, OTHER VOLTAGES UPON REQUEST

Depending on available power, the user can choose from any operational point - data shown corresponds to 12 V configuration.

MODULARITY

The IFM Nano Thruster can be clustered in order to meet any specific mission need. As we are using a number of pre-qualified modules (building blocks), this customization can be done without increasing the cost or lead times of the thruster.