

Category: Automation & Robotics

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phySPACE™ - Stepper Motor Series

PhySPACE™ stepper motors are cost-efficient, clean and reliable even within extreme environments. The phySPACE™ series is developed and built to resist vacuum, vibrations, low/high temperature and radiation while maintaining high performance, precise positioning, long life.

Standard

- 2-phase stepper motors
- holding torques from 3.1 to 420 mNm without gearing
- diameters from 20 to 57 mm
- 200 steps (1.8° per full step)
- designed for high shock and vibration loads
- 4 leads parallel
- preconditioned, protection IP 20
- embedded K-type thermocouple
- Ambient temp. -40 °C... +120 °C
- up to +200 °C (winding)
- radiation up to 106 J/kg
- bake-out temperature up to 200 °C (24 h)
- outgassing TML <1 %, CVCM <0.1% (at <125 °C)

Options

- "light weight" upgrade (Titan)
- "space-testing" upgrade (vibration, shock, thermal cycling)
- Winding cold redundant
- for Cryo applications up to -269 °C

Customised Solutions

- special designs based on the phySPACE series
- Gears



Innovative Aspects:

Performance & Lifetime

phySPACE™ motors are based on a technology that can also be found in the most challenging projects of our time. From a variety of satellites up to the Mars rover Curiosity: the offered motors drive applications in distant worlds - highly accurate, reliable and durable. Driven within their specification range, high-quality components and a proven design make sure: These motors won't let you down!

Cleanliness

The offered motors for use in space contain only materials that also meet the requirements of the ECCS (European Cooperation for Space Standardisation). Thus, each material has a maximum TML (Total Mass Loss) value of 1% and a maximum CVCM (Collected Volatile Condensable Materials) value of 0.1 %. The space motor is delivered to customers double-wrapped and vacuum-sealed.

Structure design

The structure design of the phySPACE™ motors presents an optimum of lightweight, stiffness and surface protection. As is commonly done in high-vacuum class all structural elements such as housing, flanges and shafts are made of stainless steel. Even the standard version in stainless steel is optimized in terms of weight: The quadratic flange is reduced to flange lugs and the flanges are hollowed to save additional weight. In order to save even more weight the phySPACE™ comes with the option for a „lightweight“- material like titanium.

Radiation resistance

The phySPACE™ motors are designed for radiation of up to 106 J/kg for use in space applications. A motor not designed for radiation will not only suffer degradation of the insulation and the adhesives – especially the grease of the ball bearing reducing the efficiency and will eventually cause the motor to fail.

Bearings

The shock and vibration loads of a rocket launch can stress or damage the ball bearings significantly – resulting in reduced life under certain circumstances - when the motor hasn't even been put into operation. The phySPACE™ standard motor is equipped with special ABEC 7 bearings. A duplex bearing assembly in the front flange dissipates the vibration loads safely into the housing structure. Especially when in a vacuum, unlubricated ball bearings can be affected by „cold welding“, and thus degrading and even binding the bearings.

Adhesives

The adhesives used are qualified for space applications according to ECSS Q-70-02A. They represent an optimum of strength, ductility, low outgassing rates and thermal resistance. The outgassing rates (TML, CVCM) comply with the European Space Standards and American space standard.

Temperature Management

All materials selected for the phySPACE™ motors can withstand a short-term winding temperature of up to 200° C. Due to the lack of convection in a vacuum, the motors can heat up very quickly and often work at a high temperature level - depending on the duty-cycle. In phySPACE™ motors a thermocouple is integrated to allow monitoring of the exact winding temperature. This is how motors are protected from overheating.

Preconditioning

The selected materials and components are outgassed by a technological process at up to 200°C in vacuum chambers, so that outgassing materials cannot deposit in the ball bearings or inside the motor. This way a minimum molecular contamination of the surrounding system is provided so that the motors can even operate close to optical systems.

Handling and Storage

phySPACE™ motors are primarily designed for use in a vacuum. For this reason the motors must always be handled under controlled conditions: On the ground at 20 °C +/-10 °C and relative humidity <=50%, in clean rooms and clean boxes. Long-term storage is permitted only in unopened original manufacturer packaging. After storage, or not rotating for more than 6 months, a „running-in“ is highly recommended in order to distribute the grease evenly again. The motors are to be handled with suitable gloves. Since the rotor is magnetic, it must be handled in a clean environment so that no metal particles can be pulled through the opening at the rear of the motor into the motor. Particles in the motor lead to an impairment of operation, the lifetime, or even failure of the motor due to binding.

Service, Consulting and Customising

Although phySPACE™ series integrates the technology provider's application experience of the last decades - sometimes the standard is just not enough. The technology provider offers to create customized solutions to make the motor a perfect fit for the customer's application, because sometimes even small changes make the difference.

Application Areas:

phySPACE™ stepper motors can be used in space applications, but also in standard and customized solutions where it has to resist usage in extreme environments. Beyond that it is also the basis for projects – to optimize motor-load coupling.

Cooperation:

Type of partner sought:

Industrial partners, R&D institutions. The company is interested in selling the stepper motors.

Specific area of activity of the partner:

All areas related to application possibilities of the stepper motor (space and non-space)

Task to be performed:

The technology provider is looking for partners interested in a commercial agreement with technical assistance in the fields of Engineering, technical consultancy, maintenance in order to develop and adapt the system for different applications.