maxon DC motors venture deep beneath the surface of Mars.

Landing on Mars on 26 November 2018 was NASA’s InSight mission to Mars. The InSight probe is used in the analysis of the formation of rocky planets, involving driving a measuring probe five meters deep into the ground. maxon engineers pulled out all the stops to make their motor fit for the job.

The robotic InSight probe landed on Mars on November 26. If all goes according to plan, the stationary lander will proceed to carry out various measurements over a period of two years and provide important insights into Mars and the formation of Earth. The mission is being conducted by the Jet Propulsion Laboratory (JPL) for NASA.

Motor rams penetrometer 5 meters deep into the ground
DC motors from the Obwalden-based drive specialist maxon motor are also on board. A compact motor-gearhead combination with a diameter of 22 millimeters is used in the HP3 probe developed by the German Aerospace Center (DLR). It is designed to determine the temperature profile of the planet. Specifically, the maxon drive is located in a rod-shaped penetrometer, nicknamed “the Mole” by the developers. This penetrometer is autonomously driven five meters into the ground. To achieve this, the motor tensions a spring with each revolution. The spring then releases with great force, executing a powerful downward punch. In this way, the “Mole” gradually burrows downwards – over a period of several weeks, pulling along a cable that is equipped with sensors to help the researchers determine the thermal state of the interior of Mars and draw conclusions about its origin. Since Mars is a rocky planet like Earth, the scientific results may also help gain a better understanding of our own planet.

Special solution for more than 400 g
Mars is not a very friendly environment for technology. Nonetheless, more than a hundred maxon drives have already proven their worth on the Red Planet. The current InSight mission, however, posed additional challenges for the Swiss engineers. To efficiently drive the penetrometer into the ground, the DC motor needs to withstand forces in excess of 400 g – and more than 100,000 times. It took a number of variations and failed tests to find the right solution. The result is a standard DCX 22 motor, greatly modified with additional welding rings, bearing welds and specially shortened brushes. The utilised GP 22 HD gearhead, on the other hand, only needed Mars-specific lubrication.

Say hello to an old acquaintance
The InSight probe is powered by two solar panels for the duration of its mission. To save costs, JPL repurposed designs from the successful Phoenix mission, using a maxon DC motor developed some
time ago to extend the solar panels. This type of motor, an RE 25, has ensured that NASA’s Opportunity rover has been active on Mars for more than 14 years (even if it is currently in deep sleep due to a sandstorm). Thus, two generations of maxon drives come together in the InSight robot probe to jointly contribute to the mission’s success.

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