

# Swiss motor ventures deep under the surface of Mars.

maxon is a part of NASA's InSight mission.

**In just a few days, the InSight probe will land on Mars to shed new light on the formation of rocky planets. The mission entails driving a measuring probe five meters deep into the Martian ground. maxon engineers pulled out all the stops to make their motor fit for the job.**

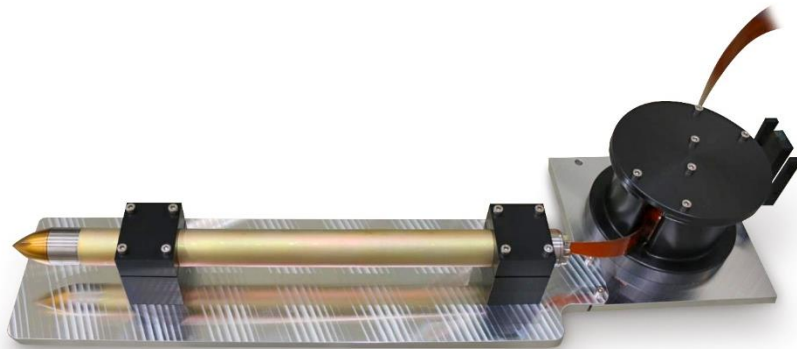
Tension is mounting among fans of space exploration, as the robotic InSight probe is scheduled to land on Mars on November 26. If all goes according to plan, the stationary lander will proceed to carry out various measurements over a period of two years and provide important insights into Mars and the 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 utilized GP 22 HD gearhead, on the other hand, only needed Mars-specific lubrication.



*The HP3 probe.  
Image ©DLR*

### 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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#### maxon motor ag

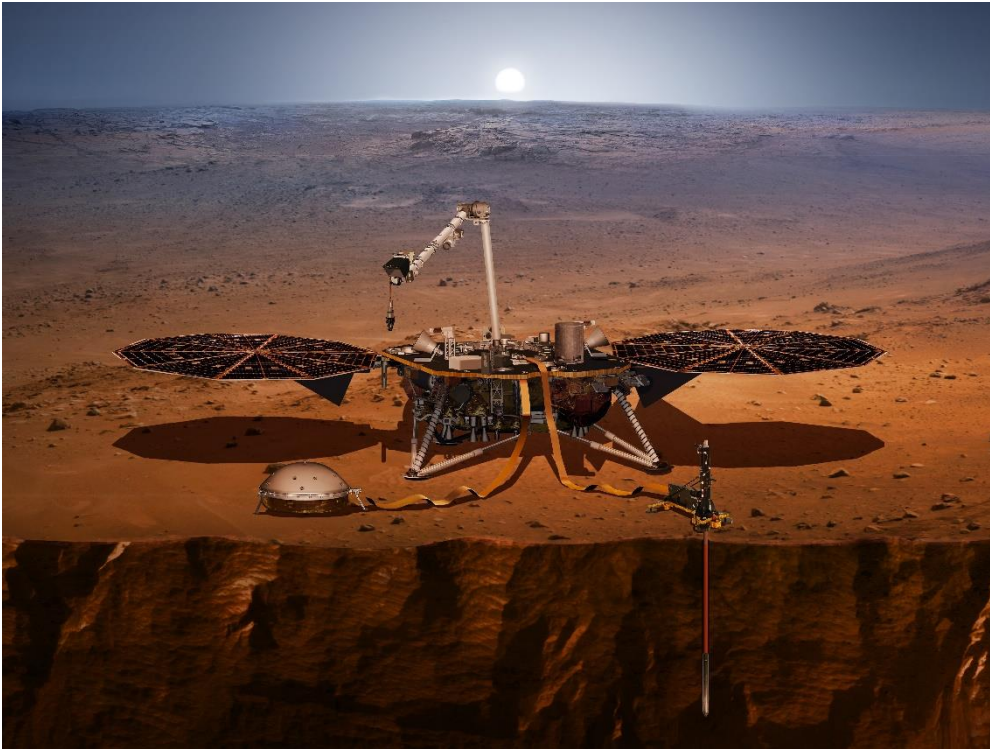
Headquarters  
Media office  
Brünigstrasse 220  
Postfach 263  
CH-6072 Sachseln  
Tel: +41 (41) 662 43 81

E-mail: [media@maxonmotor.com](mailto:media@maxonmotor.com)

Web: [www.maxonmotor.com](http://www.maxonmotor.com)

Company blog: [www.drive.tech](http://www.drive.tech)

Twitter: [@maxonmotor](https://twitter.com/maxonmotor)



Artist's rendering of the InSight lander.  
Image ©NASA/JPL

### **The Swiss specialist for quality drives**

maxon motor is a developer and manufacturer of brushed and brushless DC motors, as well as gearheads, encoders, controllers, and entire mechatronic systems. maxon drives are used wherever the requirements are particularly high: in NASA's Mars rovers, in surgical power tools, in humanoid robots, and in precision industrial applications, for example. To maintain its leadership in this demanding market, the company invests a considerable share of its annual revenue in research and development. Worldwide, maxon has more than 2500 employees at eight production sites and is represented by sales companies in more than 30 countries.