Press Release

EtherCAT in outer Space: Robustness is paramount!

EtherCAT is currently used by several projects on the International Space Station (ISS). Both in „Kontur 2“, a joint project of the German Aerospace Center DLR and the Russian Federal Space Agency ROSKOSMOS, as well as in the „Haptics“ projects of the European Space Agency (ESA).

For the first time, a robot on earth with several degrees of freedom was remote controlled from the ISS. For this task, cosmonaut Oleg Kononenko used the Joystick „RJo“, developed by the Robotics and Mechatronics Center of the German Aerospace Center. Thanks to force feedback, the user in micro gravity feels the contact forces of the robot on the ground. The sensors and motors of the joystick are networked with EtherCAT. In this DLR project, a communication link to the ISS is used that has a very short roundtrip time of 2 - 4 ms, but provides very little bandwidth and is only available for a few minutes while the ISS flies by.

In contrast, Dr. André Schiele, Head of the ESA Telerobotics & Haptics Laboratory, and his team are making use of a communication link facilitated by NASA via geo-synchronous satellites, which has much more bandwidth and almost unlimited contact time, but provides special challenges to the control algorithms due to roundtrip times of around 850 ms. ESA also developed an EtherCAT based joystick for their projects. While in Haptics-1, a set of physiological data for force feedback in micro gravity is collected, in Haptics-2, the communication link from outer space is used for tele robotics. This is similar to the Kontur-2 project of DLR, but with different control engineering boundary conditions. In Haptics-2, for the first time ever, the control of an axis on the ground with force feedback from space was realized.

“For our real-time controls we need an absolutely deterministic network, so that we know exactly the behavior of each component in the system at any time. Another advantage of EtherCAT was that we did not need any special hardware in the master, an Ethernet port is sufficient, and the rest is software” explains Dr. André Schiele on why they decided to use EtherCAT.

For Georg Plank, Serial Communication Technology Coordinator at the DLR Robotics and Mechatronics Centre, the robustness of the technology is paramount. “Besides the well-known features of EtherCAT such as throughput, determinism and universal master implementation, the reliability in space environment is most important. Therefore, the behavior of the EtherCAT Slave Controller ET1100 with different radiation sources and doses was tested. The test results show that the ET1100 meets these extreme requirements as well.”

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Picture:

Picture caption:
EtherCAT-based Space Joystick (RJo) with Force Feedback, developed by the Robotics und Mechatronics Center of the German Space Agency (DLR) (Photo: DLR/Simon Schätzle (CC-BY 3.0)).

About EtherCAT Technology Group (ETG):
The EtherCAT Technology Group (ETG) is an association in which key user companies from various industries and leading automation suppliers join forces to support, promote and advance the EtherCAT technology. With over 3,400 members from 58 countries, the EtherCAT Technology Group has become the largest fieldbus organization in the world. Founded in November 2003, it is also the fastest growing association of its kind.

About EtherCAT®:
EtherCAT is the fastest Industrial Ethernet technology and stands for high-performance, low-cost, ease of use and a flexible topology. It was introduced in 2003 and became an international standard and a SEMI standard in 2007. The EtherCAT Technology Group promotes EtherCAT and is responsible for its continued development. EtherCAT is also an open technology: anyone is allowed to implement or use it.

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