

ECSS-E-ST-50-15C Protocol On-Board SW Implementation

The use of CAN bus as the main intra-spacecraft communication interface is likely to increase in the coming years. The CAN bus is characterized by low power consumption, design simplicity and reduced complexity, which in turn impacts the size of controller components. With this shift a need arises for a reliable software framework that will allow application software to efficiently exchange data over the bus using popular CANopen standard built on top of physical CAN bus. Although CANopen itself has a multitude of available tools and devices due to ubiquity of CAN related protocols in other industries, mainly automotive and automation, the fairly young ECSS-E-ST-50-15C extension standard does not yet have a mature ecosystem compared both to the CAN-specific domains as well as other space standards.

Providing an open source library should help the space industry as a whole to develop and maintain a reusable CANopen-based toolset dedicated for space applications. Starting from an existing library is a way to exploit the experience of other industries to make a dependable library. Because of that, *lely-core* library, created and widely deployed in the robotic industry by Lely Industries N.V., was extended to facilitate space industry specific needs.

The modification of the library provides all of the features introduced by ECSS-E-ST-50-15C standard, including support for redundancy and ECSS specific time types. The modification was provided in the form of contribution to the open-source project, keeping a single code base as an important asset, making maintenance more effective and further improvement of the selected library easier in the future.

The library was verified and validated according to the criticality category B requirements from the ECSS standards. Library verification process included using automated tools to statically check correctness of the source code, the coding standard applied, coverage of tests, etc. In the end those elements became a part of the normal development process, maintained by publicly available Continuous Integration systems. The accompanying projects providing Test Environment and Test Suite were created and used to execute validation tests on a representative space-grade hardware setup – SAMV71 ARM development board. Integration tests used two applications communicating over physical CAN bus and were executed to validate all testable requirements extracted directly from the ECSS-E-ST-50-15C standard. Complete ECSS compliant documentation data package was prepared and made available for possible reuse.

As a result of the project, the open-source CANopen library for space-grade applications is available and already being deployed in commercial flight projects.