Starter kit: Hardware and software

Emotas' CANopen FD starter kit provides a CAN FD micro-controller board, an extension board with CAN FD transceiver, and a CAN FD USB interface to start with CANopen FD immediately.

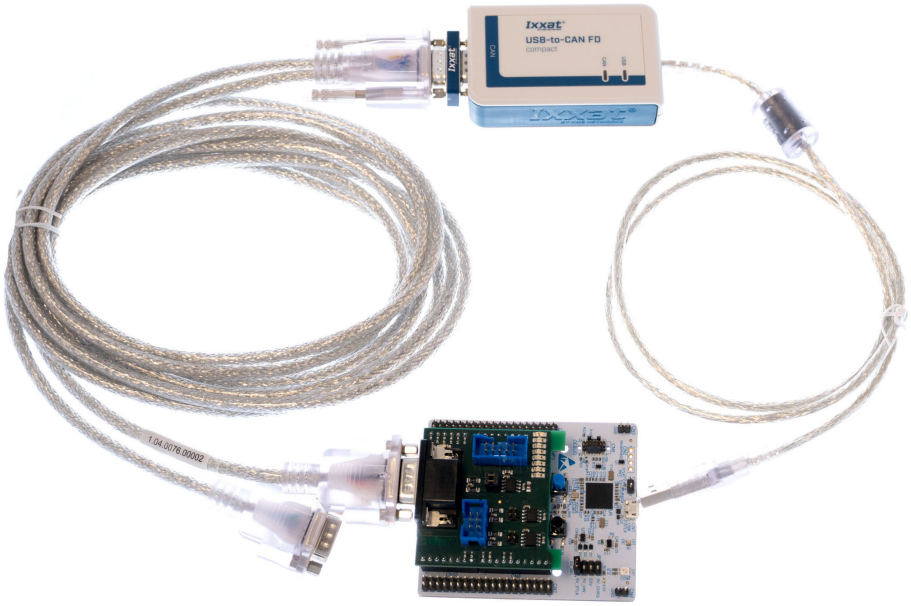

Figure 1: CANopen FD starter kit hardware (Source: Emotas)

CANopen FD as specified in the CAN in Automation (CiA) specification 1301 uses the new features of CAN FD such as a higher data bit-rate and longer frames up to 64 bytes. Most principles of classic CANopen are reused, but some are extended or modified. The most notable improvement is the new USDO service that provides arbitrary access to CANopen FD objects. Compared to the SDO service of classic CANopen it is not only faster but also provides a broad cast mechanism. The other major improvement is the extended PDO length supporting 64 bytes instead of only 8 bytes in one PDO. Last but not least the Emergency messages have been extended as well to provide more detailed information about errors detected by the device. Unfortunately, the number of CANopen FD devices available on the market is currently limited. This is also a problem for developers who would like to evaluate the new features of the improved protocol. In order to provide a cost-effective solution to get started with CANopen FD, Emotas embedded communication, a German company well-known for its CAN and CANopen FD expertise, offers a CANopen FD starter kit.

The starter kit unboxed

The CANopen FD starter kit is based on an STM32 Nucleo-64 board with a powerful STM32G4 micro-controller that internally uses an CAN FD controller that supports both Classical CAN and CAN FD. To connect the CAN controller to a CAN FD network a CAN FD transceiver is required. Emotas has developed a specific expansion board with a CAN FD transceiver and DSUB-9 connector to connect the CAN FD network conveniently. The CAN FD transceiver TJA1051 supports up 5 Mbit/s in data phase. In addition to CAN Y-cables to connect also additional devices and two termination resistors the starter kit comes with an Ixxat USB-to-CAN FD interface that supports these bit-rates as well. In addition to the hardware components, the CANopen FD starter kit also includes software: A CANopen FD slave stack to run on the STM32G4 and a CANopen FD tool with CANopen FD master and CAN FD analyzer capabilities.

CANopen FD slave stack

As reported on the CAN Newsletter Online, the Emotas CANopen FD stack was already published in 2017. Based on already three years of CANopen FD experience and recognizing the demand for smaller micro-controllers,

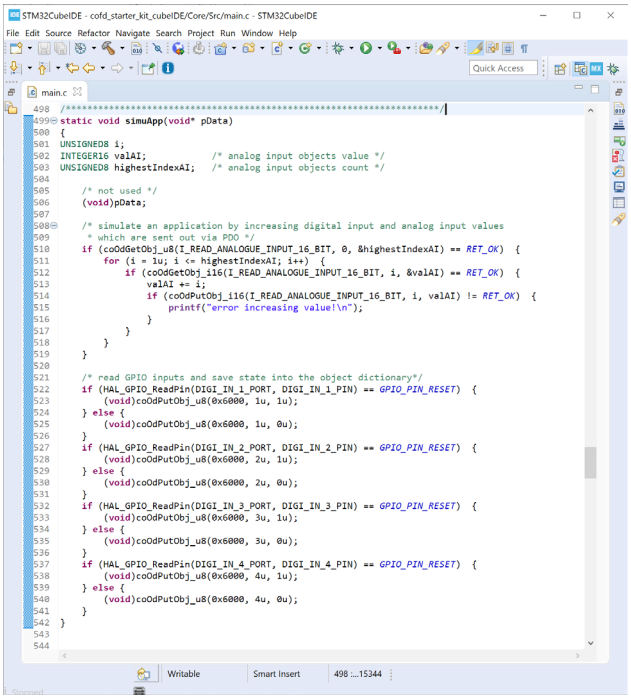

Figure 2: Screenshot application code in STM32CubeIDE (Source: Emotas)

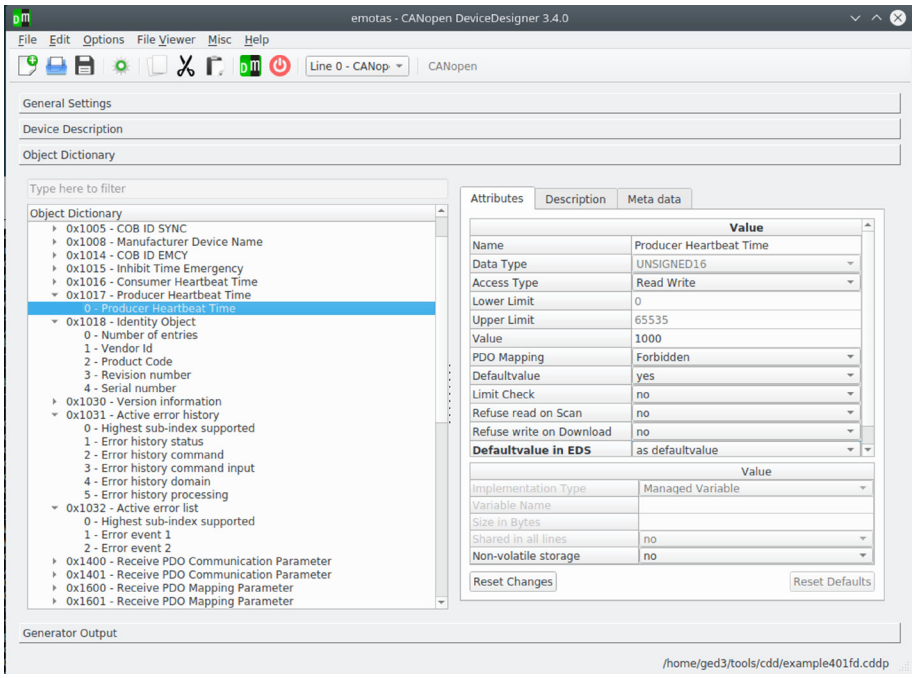

Figure 3: CANopen Devicedesigner (Source: Emotas)

the CANopen FD slave stack has been ported to the STM32G4 recently. An evaluation version of Emotas' CANopen FD slave stack runs inside the STM32G4. It is a binary library of the companies source code stack and to limit the use case to evaluation purposes, the run-time is limited to one hour after reset.

Nevertheless, it comes with the following CANopen FD features:

- NMT Slave
- USDO server with simultaneous connections (expedited unicast and broadcast, segmented unicast and bulk transfer)
- multiple PDO producers and PDO consumers
- Sync consumer
- Heartbeat producer
- 1 Heartbeat consumer
- Emergency producer

An example application is included as STM32CubeIDE project and it simulates a digital/ analog I/O device with real and simulated values mapped into longer PDO . Several data objects exceeding the length of 54 bytes are included to show the USDO segmented transfer or USDO bulk transfer as well. By default the bit-rate pair of this example is set to 500 kbit/s nominal bit-rate and 2 Mbit/s data bit-rate. But both the bit-rate pair and the node-ID can be configured from the application. So if one has multiple boards, a network with multiple nodes may be set up. Based on this example,

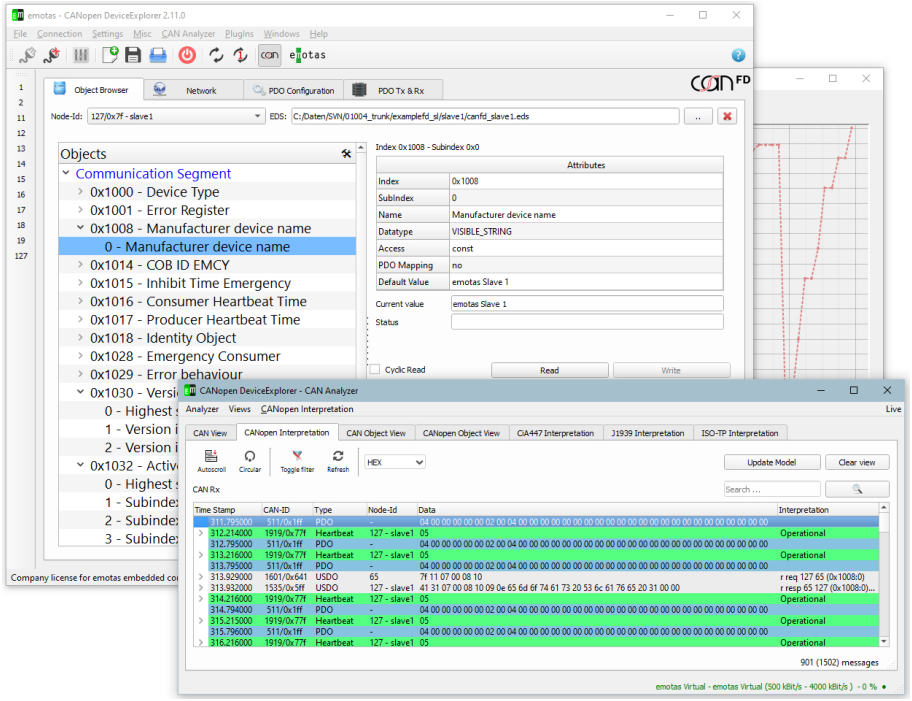

Figure 4: Screenshot CANopen Deviceexplorer (Source: Emotas)

the user can extend or modify the object dictionary of the CANopen FD device to meet his requirements. This can be realized by Emotas' CANopen Devicedesigner.

Tool based object dictionary design

The CANopen Devicedesigner allows the definition of CANopen FD object dictionaries based on pre-defined databases e.g. for all CiA 1301 objects. Additionally the user may add own manufacturer-specific and device-profile-specific objects and assign them to PDOs and configure other CANopen FD services. Based on these configurations the tool generates .c and .h files that include the object dictionary implementation and configure the stack. Additionally, the tool generates from the same source a documentation of the object dictionary in CSV, TXT, and HTML files and both a classic CANopen EDS file and a new CANopen FD XDD file according to the latest state of the specification. This XDD file can be imported into CANopen FD tools or CANopen FD masters so that these tools and masters are aware of the slaves' object dictionaries.

CANopen FD master tool with CAN FD analyzer

In order to control a CANopen FD slave device a CANopen FD master is required. Instead of a master device, a PC-based master tool is used to provide a high flexibility especially for development or evaluation. The CANopen Deviceexplorer is such a CANopen FD master tool and additionally includes a sophisticated CANopen FD analyzer that interprets the raw CAN FD messages according to the CANopen FD specification. By using the tool one can access the device' object dictionary by USDO, configure, send and receive PDO and send NMT commands and monitor the raw CAN FD messages and their CANopen FD interpretation simultaneously.

The delivery includes the version for Windows, but the versions for Linux and macOS are available on request. The provided evaluation version of the CANopen Deviceexplorer can only be used with a fixed bit-rate pair of 500 kbit/s and 2 Mbit/s. Object dictionary access, PDO configuration, and NMT commands are limited to the node-IDs 1, 2, 32, and 64. In addition to that, all CANopen FD master features of the tool are enabled and the integrated CAN analyzer interprets all CAN FD messages from all nodes.

Conclusion

The CANopen FD starter kit provides all necessary components to start with a CANopen FD slave development or to evaluate the possibilities of the CANopen FD protocol. In order to spread the usage of CANopen FD, Emotas Embedded Communications not just offers the starter kit for sale, but also provides all software components for download for free.

Author

Torsten Gedenk
Emotas Embedded Communication
ged@emotas.de
www.emotas.de

TTControl
HYDAC INTERNATIONAL

Vision 3

Enhance human machine interaction

TTControl's rugged operator interface family Vision 3 was specially designed to meet the requirements of the harsh and more and more digitized off-highway environment.

Features like four simultaneous video streams, support of hardware-accelerated 3D animations, user inputs through a multi-touch capable screen and acoustic feedback via an integrated loudspeaker ensure a perfect interaction of the operator with the vehicle for safe and efficient machine operation.

more information
www.ttcontrol.com/vision3
products@ttcontrol.com