CAN Newsletter Online

CAN FD PLUGFEST

Proof of robustness for CAN FD

Happy faces, some minor issues, and two days full of experience: The second CAN FD plugfest in Detroit saw about 40 participants from 20 parties. To the organizers, the plugfest proofed the robustness of the CAN FD technology.

Despite cable spaghetti and not always optimized connections, most of the planned tests were performed successfully (Photo: CiA)

In plugfests the participants proof the interoperability of their CAN FD implementations. Dr. Arthur Mutter from Bosch managed the technical part of this two-day event. The first day focused on the data link layer. For this purpose, two groups connected their CAN FD nodes to a non-optimized linear network with very short stubs. In the beginning, the basic functionalities such as sending and receiving messages were tested. As arbitration bit-rate 500 kbit/s was used. The data-phase bit-rate was increased from 1 Mbit/s up to 6,7 Mbit/s. Some nodes failed at higher bit-rates due to software problems, an not optimized bit-timing setting, or they were not designed for higher bit-rates. In accordance with the recently finished SAE J2284-4 specification, the sample point for the arbitration and the data-phase was set to 80 %.

> Torture testing our CAN FD Controller IP Core at the Detroit @CANopen Plug Fest, with @FraunhoferIPMS pic.twitter.com/xlKwzceegF
>
> — CAST, Inc. (@castcores) April 7, 2016

"This was a very valuable event," said nearly all participants, no matter if they were chipmakers, device designers, tool provider, or OEMs such as Ford and General Motors (GM). Denso, Microchip, and Texas Instruments tested their transceiver chips qualified for bit-rates higher than 1 Mbit/s. CAN FD implementations from Bosch, Cast/Fraunhofer, Cypress, Denso/C&S, Kvaser, Microchip, Peak/Grid Connect, and Renesas were used by several parties. Etas, Intrepid, Kvaser, Peak/Grid Connect, and Vector provided device-level products. K2L and Vector analyzed the communication by means of their CAN FD analyzing tools. The signal quality was observed by Teledyne LeCroy's oscilloscopes, which provide an ISO CAN FD analyzing software package.

> Debugging #CANFD with our #oscilloscope at the Detroit @CANopen Plugfest pic.twitter.com/f9C21x8dKc
>
> — Teledyne LeCroy (@TeledyneLecroy) April 6, 2016

After the networks were running, a pattern generator sent frames with not nominal bit-rates (-1,5 % and up to +2,5 %) without causing communication problems. Another test introduced glitches in the res-bit. All CAN FD controllers ignored them as specified. Also, the shorting of the res-bit (just 1,85 µs instead of 2 µs) meaning the BRS-bit started earlier was successfully tested. Such tests are standardized in ISO 16845-1. This standard is in progress. Just a few editorial improvements have to be implemented. All connected CAN FD controllers ignored correctly those fixed value bits (e.g. SRR and RSS) transmitted with the opposite value. All nodes also accepted the late arrival of the ACK-bit. These additional tests were performed with a 2-Mbit/s data-phase bit-rate.

Some impressions of the second CAN FD plugfest in Detroit (Photo: Ford)

Testing the physical transmission

On the second day wiring harnesses from Ford and GM were tested. Both were linear networks with few stubs. All edge-shifting tests were successful at a data-phase bit-rate of 2 Mbit/s. Higher bit-rates were tested as well. This means there is a bit of a safety margin in the tested network topologies. Most interesting was the third test with a three star topology by Denso. For the first time the Japanese company demonstrated that its RSC (ringing suppression circuitry) works successfully even in a challenging topology. In the beginning, there was some trouble with noise introduced by not optimized power supplies and not optimized device designs.

The next two-day CAN FD plugfest is scheduled for June and will take place in Nuremberg. "We will consider the results from Detroit and adjust the tests," said Holger Zeltwanger from CiA. "We will also test long cables up to 250 m; this we have skipped due to running out of time." Dr. Arthur Mutter said that the plugfest has proven the robustness of the CAN FD technology, in particular the shortening and lengthening of some critical bits did not cause malfunctions. "This was what we like to see," he summarized the results of the event. CiA organized the event and Ford provided the facilities. On request, CiA will also organize such CAN FD plugfests in other locations, e.g. in Far East.

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