CAN-to-Flexray gateways and configuration tools

Flexray and CAN networks will coexist in the next generation of passenger cars. Flexray originally designed for x-by-wire applications gains market acceptance particularly in driver assistance systems. Nevertheless, Flexray applications need information already available in existing CAN in-vehicle networks. Therefore, CAN-to-Flexray gateways are necessary. Besides deeply embedded micro-controller with CAN and Flexray interfaces, there is also a need for gateway devices as interface modules for system and network design tools as well as for prototyping. Several companies have already launched CAN-to-Flexray gateway devices.

Elektrobit has introduced the EB 61x0 gateway. It features Flexray and CAN interfaces as well as analog and digital inputs(outputs). It comes in a rugged housing and is designed as a multi-purpose hardware. SilverAtena provides a configurable gateway module for the bus systems Flexray, CAN, LIN, and Ethernet, which offers signal conditioning and the possibility to include user applications. The module is available as a single or double gateway. It supports Fibex and dbc file formats. It also provides an interface to HIL systems by Dspace.

Vector offers the CANalyzer, Flexray analyzing tool. It analyzes and monitors different communication technologies such as Flexray and CAN simultaneously. The basic functions include:

- Listing bus data traffic (tracing)
- Graphic and text displays of signal values
- Interactive sending of predefined PDUs and frames
- Statistics on nodes and messages with the Cluster Monitor
- Logging messages for later replay or offline evaluation
- Display of cycle multiplexing, in-cycle repetition and PDUs in the analysis windows

Agilent also provides an analyzing tool for Flexray and CAN. The PC software package allows users to operate the VPT1000 (including with MSO7000-Option FR2) gateway by means of a graphical user interface. It is possible to visualize and analyze the received analog and digital signals. Bus statistics are displayed as well. With the high-precision time-stamp all monitoring channels it is possible to compare timing relationships and identify timing problems.

GTI has developed a gateway, which provides two CAN and two Flexray ports. It is based on the MPC5554 micro-controller. The gateway is intended to be used for diagnostic purposes, generating start-up/sync frames, and it can be used with existing software tools.

The TTXConnexion by TTXControl is a gateway tool combining data manipulation, on-line viewing, and logging for Flexray and CAN networks. The gateway provides bus-termination that may be switched on and off. The updated version of the device is smaller and features a space-saving connector concept. The software provides an optimized trigger concept including visualization of configured triggers. The gateway’s power management functionality offers configurable sleep, wake-up conditions, and hold times. The data manipulation functionality has been extended in order to enable the user to apply a specific manipulation function several times. Also available for TTXConnexion is the PC tool TTXAnalyze, which allows simultaneous viewing of traffic, carried on the various bus systems.

The Flexray/CAN gateway by Ixxat is a configurable PC application allowing Flexray messages and signals to be transferred to CAN networks. Working in both directions this is especially useful for applications, where existing CAN-based measurement and control technology has to be integrated into Flexray environments. Another use is the integration of a Flexray control unit in the CAN in-vehicle networks. In addition, CAN-to-CAN and Flexray-to-Flexray data exchange is possible. The gateway with configuration software for the PC and a gateway runtime application, which is executed on the hardware platform. The software on the PC is required to define the gateway configuration. After downloading to the target hardware, the gateway application runs independently of the PC. The gateway from Ixxat can be used for residual bus simulation for Flexray and CAN systems.

Based on the Fibex description file normally used for the Flexray bus, code is generated for the hardware platform used, which trans-

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Fig. 1: Agilent's gateway
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freely-configurable screens on a 7-inch WVGA

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- SAE J1939
- CANopen
- NMEA 2000
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mits the messages required for communication with the necessary CRC (cyclic redundancy check) checksums and alive-counters according to the specified cycle. This ensures the operability of the Flexray.

The PC-based configuration software by Ixxat is used to allocate signals on the Flexray bus to signals on the CAN network (and vice versa) via a graphical interface. The signals specified in the Fibex bus description file or CANdb can be selected and allocated by drag-and-drop. The software supports user inputs by suggesting signals with relevant names. A description file is optional for CAN. If no description file is available, the user can also specify the messages or signals manually. The tool checks all allocations for consistency, i.e., the data length and data type of the input and target signal are compared. In the event of inconsistencies, the user is notified of this by means of a warning or error message. All CAN interfaces provided by the hardware platform can be used to transmit signals. Generally, only some of the signals on the Flexray bus are relevant, so that the bandwidth of the CAN networks is sufficient. If the available bandwidth is exceeded, the user is notified with a message. After completed configuration, the software calculates the allocation of the signals and provides them in the form of a loadable table. All files of a configuration can be stored in one project and reloaded later for additions or modifications. With a download dialogue, the necessary files and code can be transferred to the hardware platform. The user can decide whether the configuration is stored in the RAM or in the flash memory of the hardware platform. After a successful download, a connection to the PC is no longer necessary.

The hardware platform used for the Flexray to CAN gateway is the Flexray CCM or the FRC-EP150. Both units from Ixxat have a robust housing, an extended temperature range and a wide supply voltage range. The units are therefore ideal for use in vehicles or in the rough environment of a test bench. The Flexray/CAN gateway configuration can be stored in the flash memory of the units. In this way it is possible for the units to also start the gateway application independently after a power-on without a connection to the PC. Due to this stand-alone capability, pre-configured units can also be installed in inaccessible places in the vehicle or test bench.

In particular in test systems for automotive electronics, Flexray-to-CAN gateways are required. Eberspächer has introduced the Flexcard PMC II, which provides Flexray, CAN, LIN, and Ethernet ports. The gateway has been developed specifically for hardware-in-the-loop applications. The company that offers a broad range of Flexray interface boards cooperates with National Instruments (NI) and supports the Labview software. Using the “virtual instrument” approach, the user can run Labview applications on the gateway.

Ixxat has introduced the Carcorder, a data logger for automotive communication systems, and the CANobserver, a tool for physical and logical long-term monitoring of CAN networks. The data logger is available as Basic or Plus version. The Basic version provides six CAN interfaces (compliant to ISO 11898-2 or 11898-3), two LIN and two EIA-232 interfaces, an USB host/device interface as well as an interface switchable between SAE J1850 and K/L-Line. In addition, the device comes with digital and analog inputs and outputs each providing eight channels. The Plus version offers additionally two Flexray interfaces.

The data logger comes with a rugged aluminum case, an integrated UPS for up to 10 s of power cut and it has a power consumption of less than 10 mW in deep sleep mode. The wake-up is initiated with the first valid message, which will be recorded also. With the PC-based software tool, the data logger can be configured via Ethernet, direct USB connection or an USB stick. The software also enables the user to define trigger conditions and to set up diagnostic tasks. The bus-configuration is done by importing the related bus description files (CANdb, Fibex, A2L, ODX, open XML).

The bus monitor is suitable for CANopen and DeviceNet. The device is permanently integrated into the network and monitors and records continuously the data transfer (up to several years). Sporadic negative impacts, such as external EMC interferences or a slowly deteriorating signal quality caused by worn plug connections can be detected by the physical layer diagnosis and logical frame monitoring in a timely manner. The device comes with LEDs to display busload and error status and optionally the power supply status. An Ethernet interface is used to connect the monitor device to the PC, which also enables the operation of the device by an easy to use web interface. Recorded messages can be stored using the universal XML format.

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All-in-one USB adapter for communication through USB, CAN, and RS-232.

PCAN-cPCI
CAN interface for cPCI slots. Available as 2-channel and 4-channel opto-isolated versions.

PCAN-MicroMod
General purpose I/O module with CAN interface. Completely configurable via the included configuration software.

PCAN-MicroMod Baseboards
Application-specific PCAN-MicroMod baseboards. Available in different versions, incl. configuration software.

PCAN-Explorer 5
The universal tool for developing and monitoring CAN networks.
- Extensive user interface improvements: File management via projects, configuration of all elements with the property editor, and window arrangement using tabs
- Simultaneous connections with multiple networks / CAN interfaces of the same hardware type
- Configurable symbolic message representation
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