

Tx	Identifier	Description	Cycle No.	Channel	Data
Static	1	Wheel speed FL	32	AB	7346 7934 6883 6689 3048 6834 3896 7348
Static	21	Ignition	1	AB	7904 8789 6789 0648 0978 4878 4087 9848
Dyn	65	Terminal 30	*	A	4369 0698 5368 9358 9680 5379 0890 4578 8594
Dyn	65	Steering angle	*	B	6735 8763 5845 7648
Dyn	69	Wheel acceleration FL	*	AB	3466 3547 4676

FlexRay

PC Interfaces
 Analyzing Tool
 Rest Bus Simulation
 Gateway
 Development Services



IXXAT offers highly-sophisticated products for FlexRay, like the Multibus Analyser and the FlexRay CCM PC Interface, as well as consultation and development services.

Multibus Analyser

The Multibus Analyser is used in conjunction with the FlexRay CCM PC interface and provides functions for receiving, transmitting, tracing and storage of FlexRay and CAN messages as well as functions for residual bus simulation on FlexRay and CAN. All signals transferred via FlexRay or CAN can be interpreted and displayed in graphic or in text format.

Software Architecture

The software package is based on a modular client-server concept. Communication with the FlexRay hardware is carried out centrally via a communication server (**Control Panel**). The actual analysis functions are provided by separate function modules.

The Control Panel is used for configuration of the FlexRay CCM PC interface and to assign the function modules to the FlexRay or CAN channels. All data transfer between the hardware and the function modules are managed by the control panel.

The assignment of function modules utilizes highly intuitive drag-and-drop features and interface channels are displayed in the form of a tree. Via the control panel, selected mod-

ules may be arranged, minimized and restored. The control panel application saves the controller parameters, the window arrangement and all other module settings in a central configuration file and provides a central logging event that is used for status or warning messages.

Reception and Display of Messages

The **Receive Module** provides an online display of FlexRay and CAN messages (raw data). The messages can be displayed in scroll and overwrite mode. In scroll mode, the FlexRay messages are displayed with a timestamp, channel number, cycle number and ID. In the overwrite mode, the messages are displayed and sorted in the order of either the identifier, the channel number or FlexRay cycle and are always updated by the latest received messages.

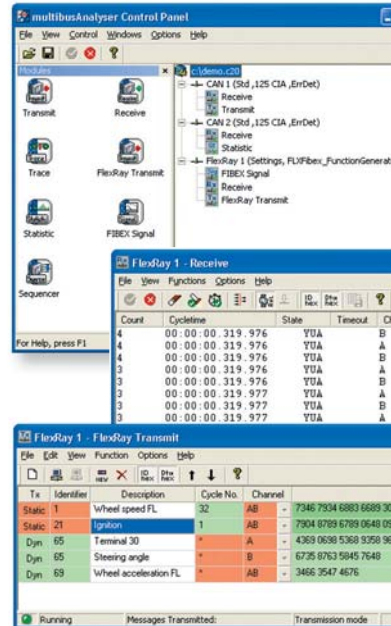
The Analyzer displays and stores the messages with message

name, channel number, cycle number, ID and Data. The messages are tagged with several flags, e.g. static, dynamic, null, sync, start-up frame, syntax and content error. As a special feature, the receive module highlights the contents of a message which has changed in order to make the changes obvious. The receive module provides filter functions for selecting and displaying data with respect to message content, channel number, ID, cycle and cycle repetition. In combination with the FlexRay CCM an asynchronous analysis is also supported.

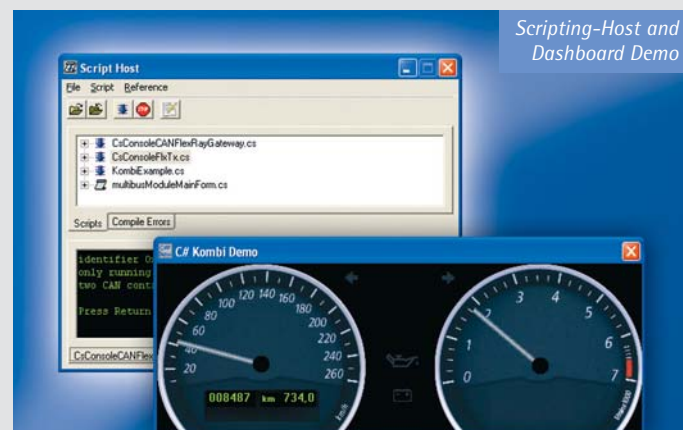
Transmitting of Messages

The Multibus Analyser can also be operated as a network node for

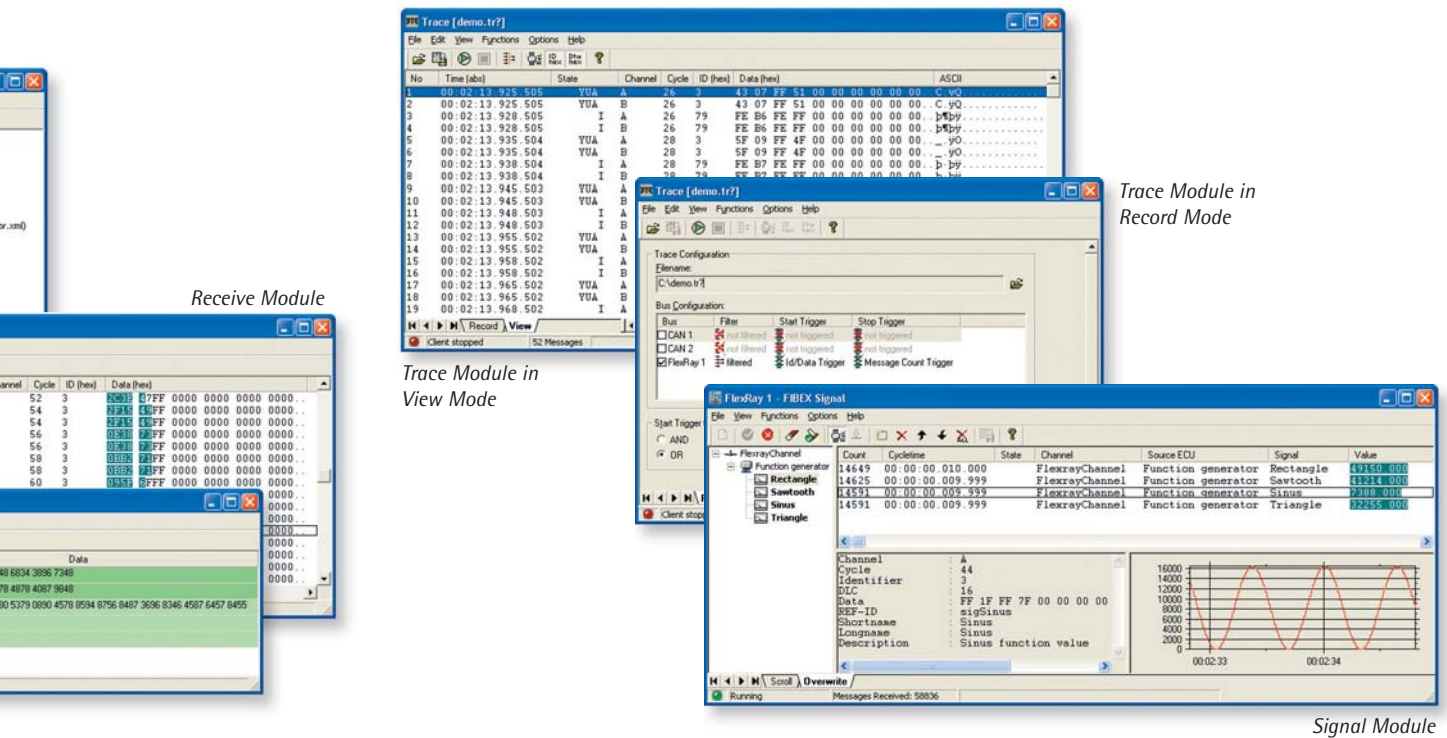
Control Panel



Transmit Module



Scripting-Host and Dashboard Demo



Receive Module

Trace Module in View Mode

Trace Module in Record Mode

Signal Module

transmitting pre-defined FlexRay or CAN messages. Static or dynamic FlexRay messages can be transmitted by the **Transmit Module** for stimulation of other network nodes.

Recording Messages

The **Trace Module** allows users to log bus traffic of up to two FlexRay and two CAN communication channels on a hard disk for off-line analysis. The received messages (with timestamp, channel, cycle number and ID) as well as relevant errors are recorded for offline evaluation.

The trace module provides a manual start/stop function and a powerful trigger/filter mode. Trigger conditions can also be freely programmed by the Open Programming Interface. Messages can be located by means of a search function.

Display and Interpretation of Physical Signals

The **Signal Module** features the ability to interpret signals transmitted in a FlexRay or CAN message. The data interpretation rules are defined according to the ASAM data description standard "Fibex".

Signals can be decoded automatically and displayed in plain text with its scale unit.

Similar to the receive module, a scroll and an overwrite mode is available for displaying the interpreted signals and the signal module provides a cycle time monitoring feature.

The tree structured display shows the information with cluster, ECU and signal, similar to the real system.

Programming Interface

A special feature of the Multibus Analyser is its Open Programming Interface. With this interface, the user is able to develop new and independent modules with Windows development systems (e.g. Visual Studio .NET) and to add these to the existing module pool. The Open Programming Interfaces features the ability to develop customized modules that are related to specific requirements.

Rest Bus Simulation on PC and Scripting Host

By using the scripting host, C# scripts can be started in the

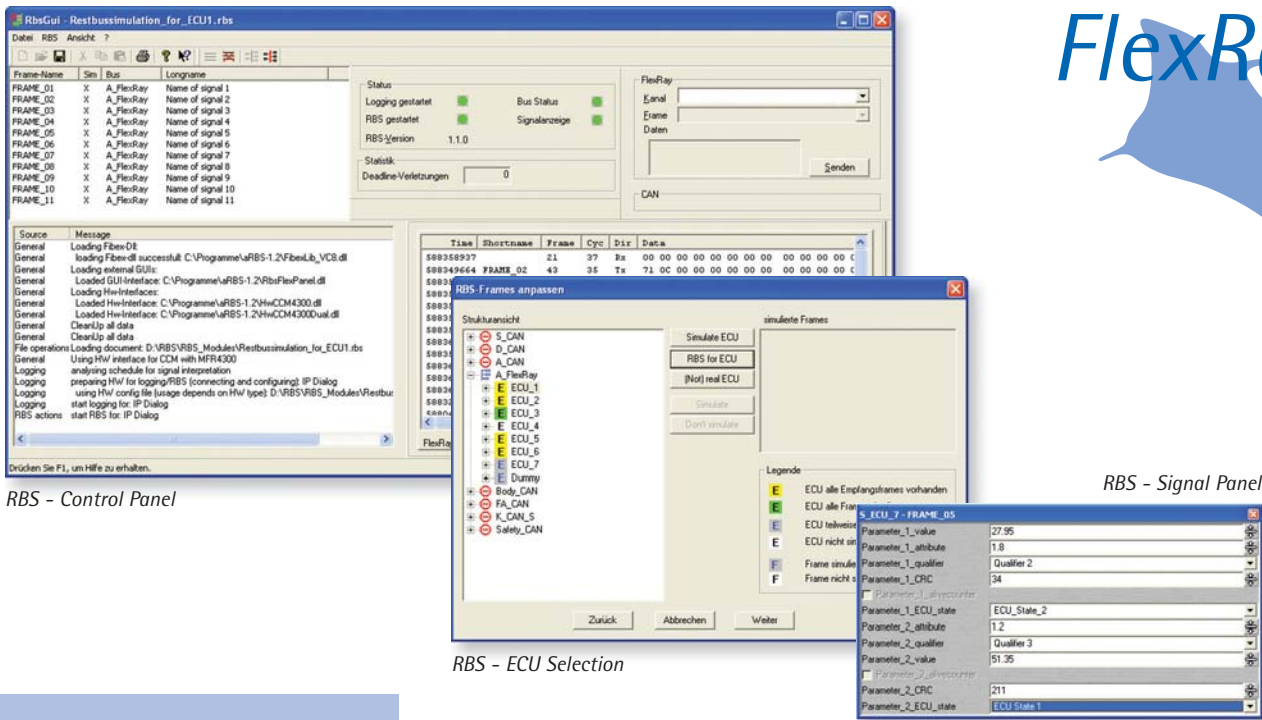
Multibus-Analyser context. Based on scripts, any analysis and simulation functionality, like customized FlexRay and CAN node emulation and test environments, can be implemented.

An additional package supports the access to signals and signal descriptions directly from C# scripts. A event oriented data interface with notification functionality enables the communication between C# script modules and performs residual bus simulation based on a standardized .net scripting environment. If increased requirements exceed a pure PC-supported rest bus simulation, for example reply to FlexRay messages in the next cycle, the user must switch to Real-Time Rest Bus Simulation that runs on the hardware of the FlexRay CCM.

Import/Export

Functionality

- Fibex for CAN and FlexRay
- Import of CANdb files
- Import of canAnalyser V2 and canAnalyser/32 databases
- Export of CSV files (Receive Module, Signal Module)
- Import of CANcorder trace files



RBS - Control Panel

RBS - Signal Panel

RBS - ECU Selection

Real-Time Rest Bus Simulation

Real-Time Operation

From the point of view of a FlexRay ECU under test, the rest bus simulation simulates the presence of other FlexRay ECUs. This means, that the rest bus simulation must transmit the required messages to the FlexRay ECU under test. If the required messages are transmitted in time (e. g. in the next cycle) it is a real-time rest bus simulation.

The real-time rest bus simulation is controlled by the PC but it runs on the hardware of the FlexRay CCM to fulfill the real-time constraints. The real-time rest bus simulation transmits the required messages. In addition, it receives the messages from the selected FlexRay ECU under test. Part of the transmitted data are processed received data.

The real-time rest bus simulation consists of several message tasks that are triggered by events on the FlexRay bus. Other tasks transfer monitoring data to the PC and receive update data from the PC.

Code Generation

The user selects the FlexRay ECU (or ECUs) under test from the Fibex file of the network. The necessary rest bus simulation code is generated automatically. The user code is added that processes received data. After compilation and linking the code is downloaded to the hardware of the FlexRay CCM. This process is controlled by the PC and can be observed via a GUI.

Simulation Control

When the user has started the real-time rest bus simulation via the GUI the generated code transmits the required identifiers with CRC codes and alive counters. The user code is executed too.

The user can watch the transmitted signals on signal panels. During the code generation process, the necessary panels have been generated automatically based on the message description in the Fibex file of the network.

The user can also change the transmitted signals via the signal panels. The next transmitted messages will include the changed value.



Technical Data

FlexRay channels	2 x 10 Mbit/s
FlexRay controller	MFR4300 or 2 x MFR4300
FlexRay access	Philips TJA 1080
CAN channels	2 x 1 Mbit/s
CAN interface	ISO/IS 11898-2 and ISO/IS 11898-3 switchable via SW
PC connection	Fast Ethernet 100 Mbit/s
Further interfaces	4 trigger outputs, 2 inputs
Microcontroller	MPC 866, 130 MHz
Memory	64 MB RAM, 32 MB Flash
Power supply	6,5 to 50 V DC
Operating Temp.	-40 ... +70 °C

FlexRay CCM

PC Interface for FlexRay and CAN

The FlexRay CCM is a multi purpose PC interface which can be used to access FlexRay and CAN networks. It provides a platform for the development of FlexRay test and service applications and can be used with the Multibus Analyser, the Real-Time Rest Bus Simulation and the Gateway add-on. The device provides a Fast-Ethernet TCP/IP (100 Mbit/s) connection to the host PC and has sufficient data processing performance (MPC 866, 130 MHz) for handling high data rates without losing data.

The FlexRay CCM is connected to FlexRay via the latest available FlexRay chip (Freescale MFR4300). An upgrade with other FlexRay silicon releases can be made by plug-in piggy-back IP modules. In addition to the two 10 MBit/s FlexRay interfaces, the device provides two CAN interfaces (ISO/IS 11898-2 and 11898-3) for reception of FlexRay and CAN messages based on the same time basis.

Four programmable trigger outputs (e.g. controlled via FlexRay or CAN) are used to trigger external hard-

ware components. In addition two trigger inputs are available. The delivery of the FlexRay interface includes a library of versatile Windows API functions which enables configuration, reception and transmission of FlexRay and CAN messages to support the development of specific PC applications. Moreover, status information of the FlexRay controller is provided. Due to the rugged housing and connectors as well as an appropriate power supply range, the device is qualified for use in automotive environments.

Dual Chip Option

With the dual chip option, the FlexRay CCM is equipped with two on-board FlexRay chips. The FlexRay CCM with dual chip option can startup the FlexRay network without the help of another node. Thus FlexRay nodes without start-up capabilities can be analyzed.

Stand-Alone Operation

The FlexRay CCM allows the implementation of specific firmware applications. IXXAT offers an embedded Board Support Package for the device as well as a basic

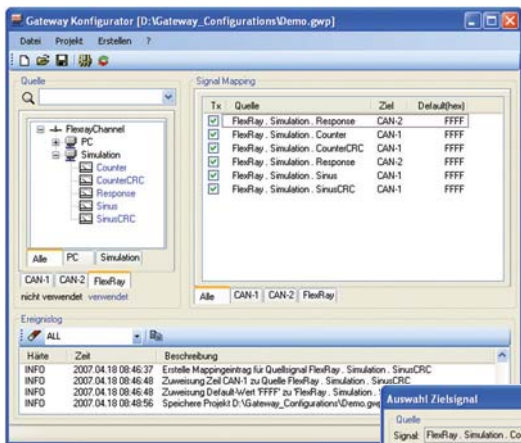
driver interface, which makes use of the internal hardware architecture. This enables the user to use the FlexRay CCM as Stand-Alone device. FlexRay and CAN messages can be received and transmitted and ECU device simulation or gateways can be implemented. For this kind of application the FlexRay CCM provides a Sleep-Mode and Wake-up functionality.

Asynchronous Analysis

The internal FlexRay protocol interpreter allows users to analyze the startup process when the on-board FlexRay chip is not yet synchronized. Later, in normal operation, the internal FlexRay protocol interpreter can show the invalid frames on the network. When the frame header is intact the frame identifier indicates the faulty node in the network.

Glitch Counter

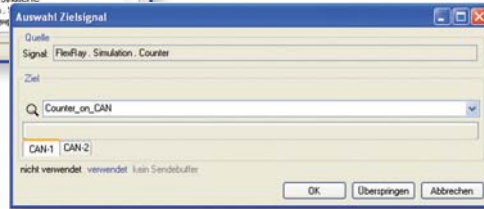
The internal protocol interpreter includes a glitch filter. Any filtered glitch increments the glitch counter. An incrementing glitch counter is a warning that should not be ignored. It indicates noise that is absorbing the fault correction capability of the on-board FlexRay chip.



Configuration GUI



Download and Control



Destination Signal with Corresponding Name

FlexRay/CAN

Gateway Add-on

Add-on

The FlexRay/CAN gateway maps FlexRay messages to CAN messages and vice versa. It is an add-on to the real-time rest bus simulation.

Configuration

The configuration software for the FlexRay/CAN gateway runs on the PC. The configuration process is based on signals. The Fibex file that describes the FlexRay network is mandatory. The Fibex or CANdb file that describes the CAN network is optional.

The user loads the network description file(s) and relates source and destination signals by simple drag and drop. The configuration software assists the user by proposing signals with corresponding names. The configuration software finds the messages with the selected source and destination signals and creates a routing table. If necessary, the configuration software can generate a CANdb file.

Finally, the routing table is downloaded to the FlexRay CCM hardware.

Operation

During operation, the real-time rest bus simulation of the FlexRay/CAN gateway is executed on the FlexRay CCM hardware. The routing table is processed and the corresponding mapping is performed. The FlexRay/CAN Gateway can operate stand-alone. The connection to the PC is not required.

Services

Development

Based on many years of experience in the development of software and hardware for communication systems and our in-depth knowledge of the FlexRay protocol, we offer development services for FlexRay-based software and hardware.

Further Tools

The following tools from other vendors use the FlexRay CCM platform:

- INCA Measurement and Calibration Tool from ETAS (with ES520)
- DTS (Diagnostic Tool Set) from Softing