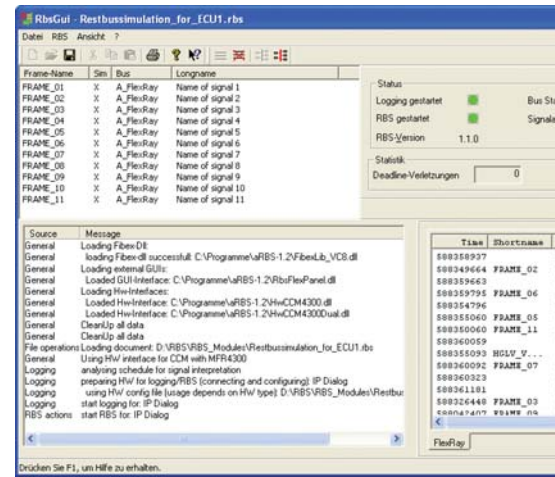


# Solutions for FlexRay



Residual Bus Simulation  
Gateway  
Analyzing Tool  
PC Interfaces  
Embedded Hardware Platform  
Development Services

**IXXAT offers highly sophisticated products and services for FlexRay for all stages of development and production.**



RBS – Control Panel

## Residual Bus Simulation for FlexRay and CAN

IXXAT is the leading supplier for proven, nevertheless advanced real-time-simulation, gateways and analysis solutions for FlexRay (and CAN).

With its series of FlexRay/CAN embedded platforms, IXXAT enables a multitude of different applications to be run on a single hardware platform – whether doing a quick or a detailed analysis of the network communication or running complex real-time simulation and implementing gateway solutions with minimal latency, the IXXAT FlexRay/CAN platforms are the solutions to be used.

The MultibusAnalyser, the embedded Residual Bus Simulation and the IXXAT gateway solutions are successfully used in all phases of the product lifecycle – from development, to testing, to production, to service – providing market leading functionality at best usability and optimized performance.

In addition, IXXAT offers consultation and development services to make your FlexRay project a success.

The embedded real-time Residual Bus Simulation (RBS) allows to simulate missing ECUs or signals and therefore to complete a network during development or testing. The Residual Bus Simulation is easily set-up using a standard PC; the execution itself is performed on the IXXAT FlexRay/CAN platforms FlexRay CCM or FRC-EP 150. This allows combining the usability of standard Windows tools with the required real-time behavior for the simulation of signals, messages, ECUs or complete network segments.

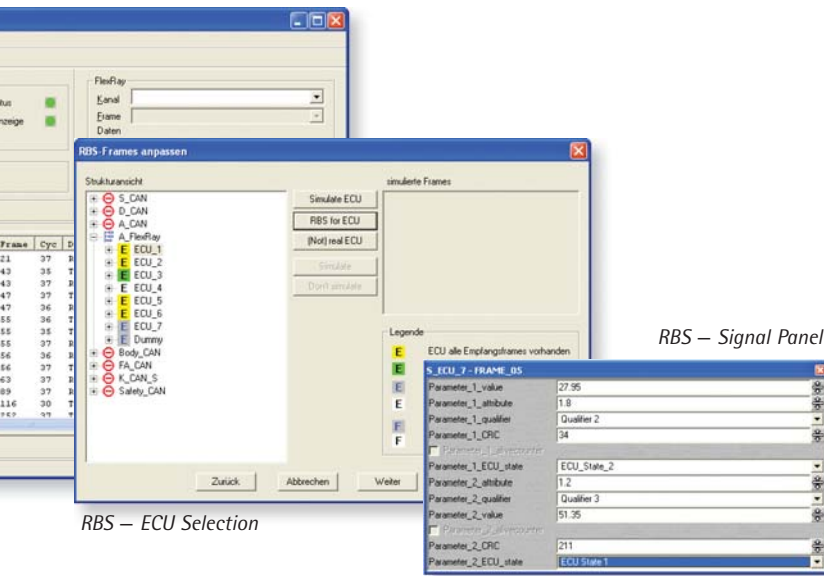
### Real-Time Operation

From the point of view of a FlexRay ECU under test, the Residual Bus Simulation simulates the presence of other FlexRay ECUs. Therefore, a real-time Residual Bus Simulation must transmit the required messages to the FlexRay ECU under test within the given time constraints. The real-time behavior of the IXXAT embedded Residual Bus Simulation is guaranteed by using suitable hardware and software provided with the FlexRay CCM and the FRC-EP 150. The Residual Bus Simulation can be controlled by a

PC, but the execution of the simulation code is done completely on the FlexRay CCM or the FRC-EP 150, thus fulfilling all real-time constraints. The real-time Residual Bus Simulation generates the required signals and messages. In addition, it receives the messages from the selected FlexRay cluster and uses the received data for the generation of response for IP messages, if required by the simulation algorithms. The real-time Residual Bus Simulation consists of several message tasks that are triggered by events on the FlexRay bus. Other tasks include the optional transfer of monitoring data to the PC and reception of updated data from the PC.

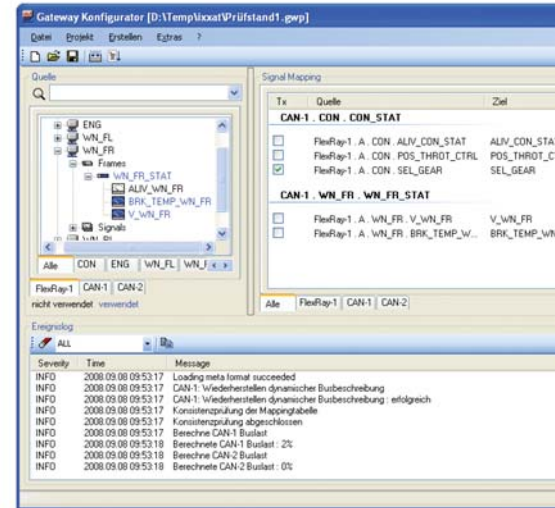
### Code Generation

The user selects the signals, messages, single or multiple ECUs under test or to be simulated from the Fibex file describing the network. The base Residual Bus Simulation code including CRC and alive counter calculation codes are generated automatically. Additional tasks or special algorithms are contained within the so-called user code. This user code is also automatically included in the simulation code.



RBS – ECU Selection

RBS – Signal Panel



GW – Configuration GUI

After automatic compilation and linking, the code can be automatically downloaded to the used hardware, either the FlexRay CCM or the FRC-EP 150.

The execution of the code can be controlled by the PC and can be observed via a GUI, or the simulation can be set-up as "stand-alone" simulation without manual interaction.

## Simulation Control

### PC-based with graphical user interface

When the user has started the real-time Residual Bus Simulation using the GUI, the generated code including user code is executed on the FlexRay CCM respectively the FRC-EP 150. The user can observe 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.

### Integrated in automated test benches

The Residual Bus Simulation can also be run without the direct control by the user. This is called

"stand-alone operation". It allows the easy integration of the Residual Bus Simulation into test benches. In stand-alone mode, the control of the Residual Bus Simulation can be done via CAN, FlexRay, trigger-lines or specific commands via the Ethernet port.

## FlexRay and CAN

The IXXAT real-time Residual Bus Simulation allows simulating signals, messages or ECUs in FlexRay and CAN networks. The simulation can be done for FlexRay or CAN only, or for both, CAN and FlexRay simultaneously.

## Flexible solution

### Growing with your needs

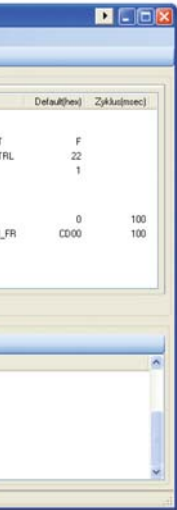
Depending on the amount of data to be simulated or the number of networks to be attached to, the simulation can also be split onto several FlexRay CCMs or FRC-EP 150s, e.g. if more than 4 independent CAN networks are required. ■

# FlexRay/CAN Embedded Gateway

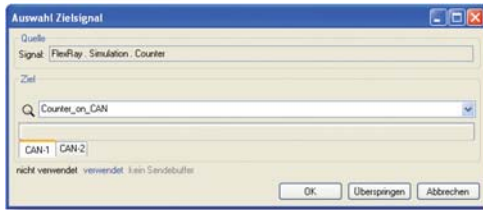
The FlexRay/CAN gateway for the FlexRay CCM and the FRC-EP 150 allows the upgrade of existing test benches with FlexRay connection without the hassle for hardware and software changes of the test bench itself, as the FlexRay attachment is done via the external FlexRay hardware from IXXAT. This enables quick and easy upgrade and usage of the test bench. The IXXAT FlexRay/CAN Gateway solution has proven to be the most reliable and easy-to-use solution on the market, being successfully used by diverse suppliers for different car manufacturers. The FlexRay/CAN gateway maps FlexRay messages to CAN messages or CAN messages to CAN messages and vice versa. The FlexRay/CAN gateway is based on the embedded real-time Residual Bus Simulation from IXXAT, thus it is also possible to combine the gateway functions with simulation tasks.

## Configuration

The configuration of the FlexRay/CAN gateway is quickly done using the FlexRay/CAN gateway configuration tool, running on a standard PC. The configuration process is based on signals.



GW – Download and Control



GW – Destination Signal with Corresponding Name

# MultibusAnalyser

The user loads the Fibex and optional CANdb network description files and relates source and destination signals by simple drag and drop. The configuration software assists the user by proposing matching target signals. If no matching target message can be found in the network description or no description is available, the configuration software allows generating a CANdb file with the required messages. Based on the selected source and destination signals, the configuration tool creates the gateway routing table. The generated routing table is downloaded to the FlexRay hardware for execution. The configuration software allows to decide, whether the downloaded routing table is stored in the RAM or in the FLASH memory. When choosing the FLASH memory option, the gateway is automatically started upon every power-on of the FlexRay CCM and FRC-EP150.

## Operation

During operation, the real-time Residual Bus Simulation part of the FlexRay/CAN gateway is completely executed on the IXAT FlexRay hardware. The routing table is processed and the corresponding mapping is performed. This provides minimal latency and best performance. The FlexRay/CAN gateway is normally operated stand-alone without connection to the PC. ■

The MultibusAnalyser is used in conjunction with the FlexRay CCM or the FRC-EP150 and provides functions for receiving, transmitting, tracing and storing of FlexRay and CAN messages as well as functions for detailed analysis and Residual Bus Simulation for FlexRay and CAN.

## Software Architecture

The MultibusAnalyser is based on a modular client-server concept. Communication with the FlexRay/CAN hardware is done via a central 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. It also allows to save controller parameters, window arrangement and all module settings in a central configuration file as well as it is providing a central status logger.

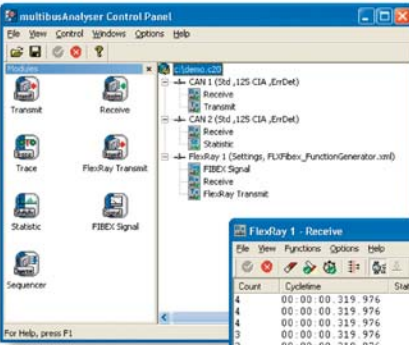
## Reception and Display of Messages

The Receive Module provides an online display of FlexRay and CAN messages. The messages can be displayed in scroll and overwrite mode, showing the messages with an accurate timestamp, channel number, cycle number, ID and data. 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. In addition, changing message data is highlighted. All messages are tagged with flags providing additional information, e.g. static, dynamic, sync, start-up frame, syntax and content error.

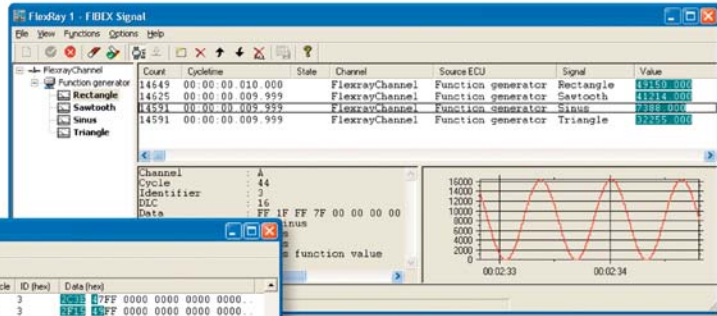
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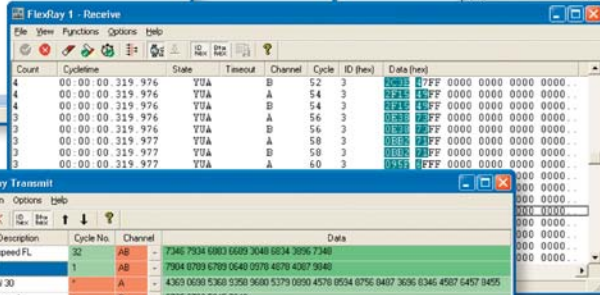
Scripting-Host and Dashboard Demo



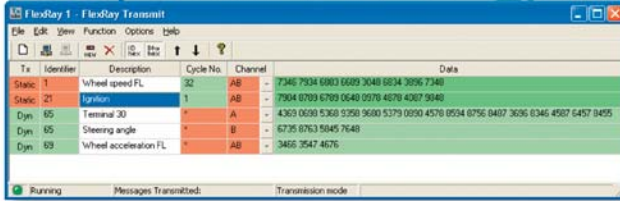
MBA – Transmit Module



MBA – Signal Module



MBA – Receive Module



... MultibusAnalyser continued

**Filter**

For all receiving modules filter functions for selecting and displaying data with respect to message content, channel number, ID, cycle and cycle repetition are available.

**Asynchronous Analysis**

The analysis of networks in asynchronous mode is a key-feature of the MultibusAnalyser, enabling easy and detailed analysis of the start-up phase of any FlexRay Network.

**Transmission of Messages**

The MultibusAnalyser can also be operated as a network node for transmitting FlexRay/CAN messages. Static or dynamic FlexRay messages as well as CAN messages can be transmitted by the Transmit Module for stimulation purpose.

**Recording Messages**

The Trace Module allows users to log bus traffic of all attached communication channels on the hard drive for off-line analysis. The received messages as well as relevant errors are recorded. The trace module provides manual control and a powerful trigger/filter mode for automated operation.

**Display and Interpretation of Physical Signals**

The Signal Module features the ability to interpret signals transmitted in a FlexRay or CAN message according to the data contained in FIBEX and CANdb network description files. Signals are decoded automatically and displayed in plain text with the according scale units. Similar to the receive module, a scroll and an overwrite mode is available for displaying the interpreted signals and the signal module provides cycle time monitoring.

**Scripting Host**

The Scripting host allows to use C# or VB.NET scripts within the MultibusAnalyser context. With these scripts any analysis and simulation functionality, like customized FlexRay and CAN node emulation or detailed analysis with graphical dash-boards can be implemented. As .NET 2.0 is used, any .NET component can easily be attached to the script.

**Programming Interface**

The MultibusAnalyser also provides a programming interface based on .NET 2.0. This interface enables the user to develop independent modules using standard development tools and to add these to the exist-

ing module pool, providing additional features in customized modules. As this programming interface uses the same command set as the MultibusAnalyser Script Host, any script can simply be compiled and added as a module. ■

**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 technology and applications, we offer development and consulting services in regards to FlexRay software and hardware. ■

**Other Tools**

The following tools from other vendors use the FlexRay CCM or the FRC-EP 150 platform:

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

# FlexRay Interfaces and Embedded Hardware

## PC Interfaces for FlexRay and CAN: FlexRay CCM and FRC-EP 150

The FlexRay CCM and the FRC-EP 150 are multi-purpose embedded platforms for FlexRay and CAN applications. These devices provide all prerequisites for the development of FlexRay test and service applications and can be used with the MultibusAnalyser, the embedded Real-Time Residual Bus Simulation, the CAN/FlexRay gateway and many more applications. The devices provide a Fast-Ethernet TCP/IP (100 Mbit/s) connection to the host PC and sufficient data processing performance (Freescale MPC 866, 130 MHz) for handling high data rates without the risk of losing data.

The FlexRay CCM and the FRC-EP 150 are equipped with the latest available FlexRay chip. An upgrade to other FlexRay silicon releases can be done with plug-in piggy-back IP modules. In addition to the two 10 MBit/s FlexRay channels, the device provides two respectively four CAN interfaces (ISO/IS 11898-2 and 11898-3 controllable via Software) for reception of FlexRay and CAN messages based on the same time basis. Four programmable trigger outputs as well as two trigger inputs are also available.

The delivery of the FlexRay interface includes a library of versatile Windows API functions (FlexRay VCI) which enables the user to build his own PC-based application for FlexRay and CAN, having access to configuration, receive, transmit and status functions.

With the rugged housing and connectors as well as with an appropriate power supply and temperature range, the device is qualified for usage in automotive environments.

### Dual Chip Option

The FlexRay CCM or FRC-EP 150 with dual chip option is equipped with two FlexRay controllers and can therefore start and synchronize a FlexRay network without the need for other start-up nodes (cold start nodes). Thus FlexRay nodes without start-up capabilities (integration nodes) can be tested with only one FlexRay CCM or FRC-EP 150.

### Stand-Alone Operation

Customer specific stand-alone applications without a PC are also possible when using the embedded real-time Residual Bus Simulation, which provides a sophisticated on-

board API. This enables the user to use the FlexRay CCM as stand-alone device with a specific feature set – from simulation tool to ECU tester and flash tool to stand-alone data logger. For those applications the device also provides a Sleep-Mode and Wake-up functionality.

### Technical Data

FlexRay channels	2 x 10 Mbit/s
FlexRay controller	Freescale MFR4310 or 2 x MFR4310
FlexRay transceiver	Philips TJA 1080
CAN channels	2 x 1 Mbit/s (FlexRay CCM) 4 x 1 Mbit/s (FRC-EP 150)
CAN standards	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	Freescale MPC 866, 130 MHz
Memory	64 MB RAM, 32 MB Flash
Power supply	6,5 to 50 V DC
Operating Temp.	-40 ... +70 °C

### Asynchronous Analysis

An additional FlexRay protocol interpreter allows users to analyze the start-up process when the FlexRay controller is not yet synchronized. Later, in normal operation, the FlexRay protocol interpreter can display the invalid frames on the network. As long as the frame header is intact, the frame identifier indicates the faulty node in the network.

### Glitch Counter

The internal FlexRay 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 diminishing the fault correction capability of the FlexRay controllers in the network. ■

FlexRay Hardware from IXXAT

