

EBERSPÄCHER ELECTRONICS | AUTOMOTIVE BUS SYSTEMS

SOLUTIONS FOR GATEWAY AND SIGNAL MANIPULATION FOR ECU TESTS



DRIVING THE MOBILITY OF TOMORROW



Eberspächer

APPLICATION: ELECTRONIC CONTROL UNIT TESTS

INTEGRATION IN ALL DEVELOPMENT PHASES

Electronic control units (ECUs) are important for ensuring the smooth operation of electronic systems in vehicles. In order to test and evaluate their functions effectively as early as the development phase, Eberspächer Electronics has developed an efficient system solution with gateway, signal manipulation and bus analysis tools. With these tools, you can test individual ECUs in the integration phase under laboratory conditions just as easily as when the system is integrated into the vehicle. To allow for a clear and simple test set-up, the solution from Eberspächer Electronics is based on very few components: the Caromee and FlexConfig PC applications, as well as the FlexXCon midjet hardware. They are not only simple to operate, but are also designed for the extreme conditions of vehicle testing.

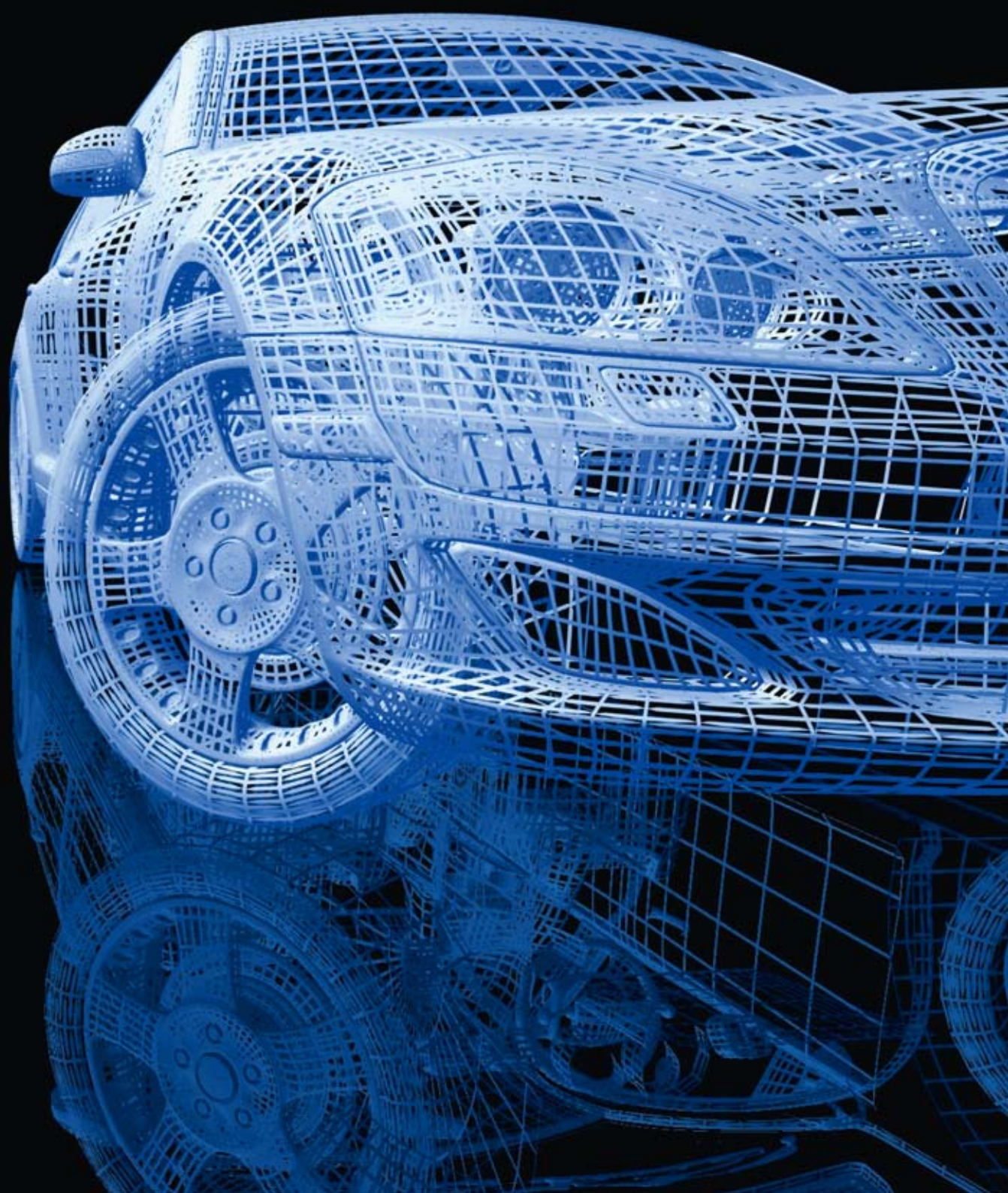
Based on the new and deterministic FlexRay bus technology, developers and engineers have numerous options during vehicle testing: they can test control units which are integrated into different networks and also transfer data via various interfaces. The gateway enables signal transfer both between FlexRay networks and between a CAN and a FlexRay network. Depending on the job at hand during the test phase, data can be transferred without being altered and so is completely transparent. Alternatively, you also have

the option of making specific changes to the signals while the data transfer is being carried out.

In order to make the work of engineers and testers as easy as possible during every phase of a project, the user interface of the FlexConfig software has a simple and clear structure. Data traffic and manipulations can therefore be easily monitored and if necessary, quickly adjusted.



Relevant phases
in the V-Model





ECU TESTS IN THE LAB

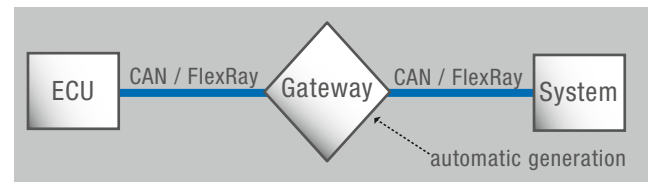
ASSESSMENT AND EVALUATION

When creating a test bench set-up in the laboratory, individual ECUs or groups of them are connected to a testing device, for example a HiL test bench. As the ECUs often come from different manufacturers, it is particularly important that the data transfer between all of the components occurs smoothly. To represent missing ECUs or partial functions, individual components must also be simulated. Eberspächer Electronics offers numerous tools to meet these requirements.

If you use several bus systems when creating a test bench set-up, data can be transferred easily between various different bus configurations via a gateway, as a message, signal or an entire data stream (included in the transport protocol). The transfer can be carried out transparently or with the option of specific changes and manipulations to signals. To do this you can automatically access the data transfer in the gateway via a PC or the test bench computer and change it as required. Time-critical messages can be transferred via the gateway, and also manipulated, if required, with the FlexXCon midget solution. This tool also enables a remaining bus simulation (RBS) to be carried out, in which messages and signals from ECUs are channeled directly onto the bus. In this way, you are in the position to work with and test all 'virtual' ECUs before

they are even available. Various control options are also available via Ethernet, for example for RBS signal values or for switching off individual ECU blocks.

Using a FlexCard as an interface, you can easily create a connection between the ECU and your PC. With the Caromee system software, you can monitor the network data traffic of your test set-up and evaluate the network management. Caromee will also record the complete data stream when analyzing your system set-up, enabling you to access and evaluate important data quickly, thanks to simple filtering functions.





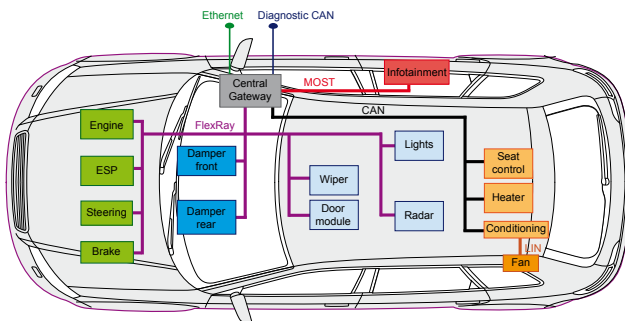
ECU TESTS IN VEHICLES

PROTOTYPE DEVELOPMENT

Realistic road tests are very important for the integration of ECUs into the system. Only in this way can the communication between the vehicle network and a prototype control unit be effectively tested and modified. Smooth data transfer is a very important factor for successful testing. Eberspächer Electronics can provide you with the solution. Using a gateway as a data interface, the network signals for the new ECU can be converted. The FlexXCon midjet hardware enables you not only to transfer time-critical signals, but also to influence or manipulate them using just the FlexXCon midjet, without a PC: signals can be changed via separate outputs during the test. To do this, you configure the gateway before a

vehicle test with the FlexConfig system software, which then runs either automatically or manually.

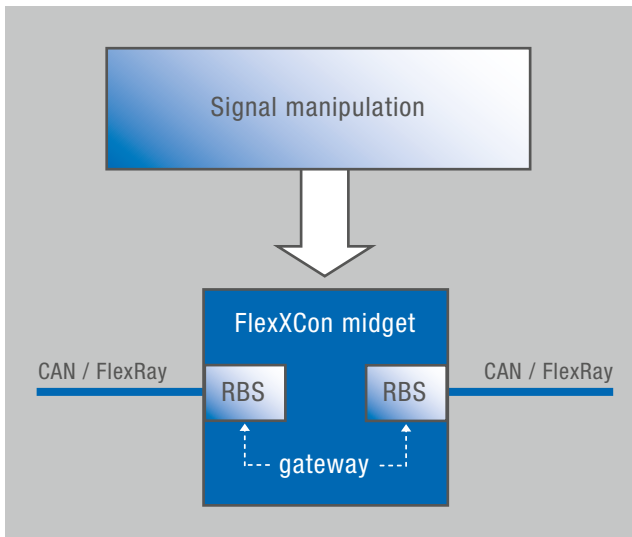
The PC-based Caromee software offers you numerous advantages for bus analysis. Large amounts of data are generated during intensive vehicle testing, which then must be analyzed by engineers and testers. Caromee can be easily connected to various different hardware tools in the vehicle via numerous open interfaces. You therefore have the option to locate faults quickly and to evaluate large amounts of data at the same time – without additional vehicle tests. Easy-to-use filter and display options, which can be used online or offline, also help things to run more smoothly. For the analysis of vehicle networks, the Caromee PC tool not only makes the data for a control unit available, but can also show the entire complexity of the vehicle network. You will therefore gain an overview of the entire network management in the test vehicle, which will show you the overall status of the system.



AN OVERVIEW OF FLEXCONFIG AND FLEXXCON

REQUIREMENTS AND SOLUTIONS

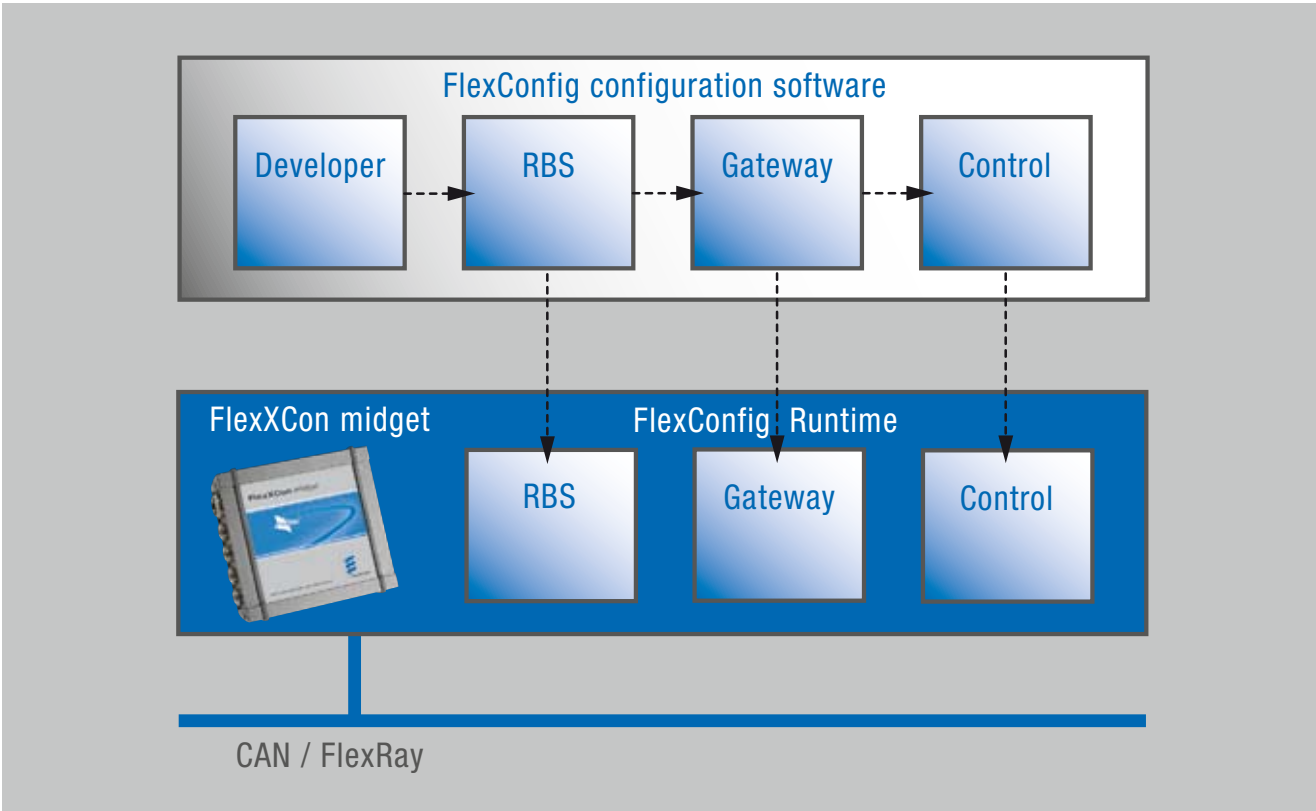
With FlexConfig and FlexXCon, Eberspächer Electronics provides you with a product group for numerous network applications that use FIBEX, AUTOSAR and DBC data formats, as well as the new FlexRay bus technology. They can be used to set up gateways between various different bus systems and remaining bus simulations, and to carry out specific manipulations of signals in networks.



If you do not have all the control units for the vehicle network available during the development phase, the FlexConfig RBS software provides you with a solution to easily simulate these during tests. In combination with the hardware FlexXCon midget, the relevant signals in the CAN or FlexRay bus can be sent and the missing ECUs simulated, thus enabling you to carry out conclusive tests. It is also often necessary to transfer data between various different networks in complex bus systems.

With the FlexConfig Gateway software, you can create a signal transfer not just between identical bus systems, but also between a CAN and a FlexRay bus.

In order to intervene and manipulate or change specific signals in a control unit test, you can easily make the necessary changes via the FlexConfig Control software, which has a graphical user interface, and then communicate these via Ethernet to the network.



FLEXCONFIG DEVELOPER

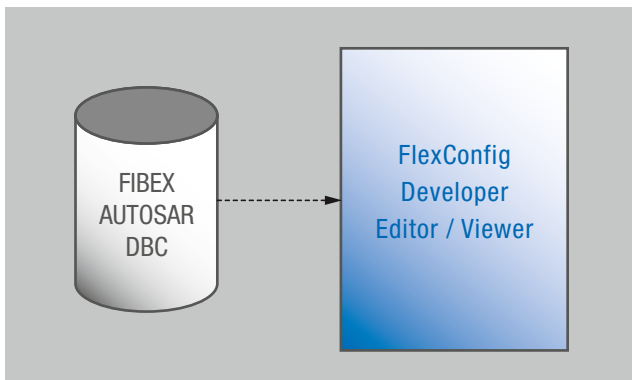
CONFIGURE NETWORKS EASILY AND EFFICIENTLY

Do you use FlexRay as a bus system for your network structure and want to define the communication between the electronic components used? With the FlexConfig Developer configuration software from Eberspächer Electronics, you can quickly and easily create the required structure in your FlexRay network using FIBEX files. FlexConfig Developer quickly provides you with an overview of

your network topology and data communication. To change these, you can configure specific characteristics of your cluster and node parameters. A full range of visual editors enables you to change the clusters, ECUs, controllers, frames, PDUs, signals, coding or units. Thanks to the interactive schedule design, you always have an overview of your network set-up and your FlexRay communication.

The integrated wizard function is also a valuable aid when configuring bus systems. This allows you to enter FlexRay parameters easily, as do the monitoring features. The software carries out a consistency test as soon as you enter any data. This ensures that only correct data is used for the bus configuration. At the same time, our FlexConfig Developer PC application establishes whether the specifications of your FIBEX files are correct by verifying them. You can therefore design your FlexRay bus effectively using the clearly laid out Windows interface of the user-friendly, powerful program and define important network parameters.

FlexConfig Developer supports many different FIBEX formats, for import and export with no losses. Comprehensive data conversion also allows the software to be used with numerous different data formats, from CAN to AUTOSAR.





FLEXCONFIG RBS

REMAINING BUS SIMULATION

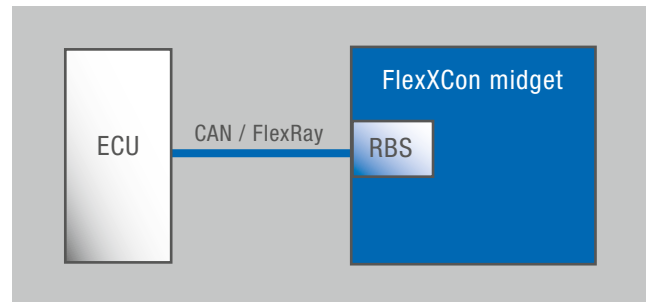
Create comprehensive ECU testing environments cost-effectively: the FlexConfig RBS system software developed by Eberspächer Electronics makes this possible. Your developers and testers can use this software as a tool to create a remaining bus simulation (RBS). This PC application was developed for the FlexXCon midget hardware. The combination of the two components not only provides you with a wide range of functions, but is also particularly easy to use.

Firstly, FIBEX, AUTOSAR or DBC files are loaded in order to configure the RBS. The default values for the signals are taken from the files. Alternatively, you can enter the default values manually via the software.

Using the editor, with an intuitive Windows interface, you can define the user functions via ANSI C code and drag & drop, and modify the RBS. Downloading to the FlexXCon midget hardware takes place directly via an Ethernet connection. Test processes can therefore also be implemented without a PC: the RBS can run autonomously on the FlexXCon midget hardware. Individual switching functions can be defined using the device outputs and can be easily accessed during more extreme tests, such as trials in test vehicles. When

dealing with time-sensitive data, your application will benefit from the hard real-time capability for CRC and alive counters, message counters and Network Management (NM). The device will start up like a control unit in less than 100 milliseconds.

As well as FlexRay, FlexConfig RBS also supports CAN bus systems and provides the ideal basis for simulating various different network interfaces in complex networks of numerous ECUs. The scope of the software's functions already cover numerous OEM variants and is being enhanced continuously by Eberspächer Electronics – a simple and easy-to-use solution, which will support you effectively in the development and modification of control units.







FLEXCONFIG GATEWAY

DATA TRANSFER BETWEEN NETWORKS

In ECU development, a new prototype is tested in a network of numerous other ECUs, for example in a test vehicle. In order to assess all the functions effectively, data must be transferred between the individual components. Developers therefore require a gateway that receives data from the different bus systems and sends it back to them again. In a test set-up with numerous ECUs communicating via a FlexRay bus system, it also makes sense to activate and test individual ECUs. Using the FlexXCon midget hardware solution, a gateway can be created for data transfer between a complex FlexRay network and an individual ECU. The gateway can be configured using the Windows-based FlexConfig Gateway software. You can also define the routings using drag & drop and transfer them to the FlexXCon midget hardware via an Ethernet connection.

With this solution for a gateway between two FlexRay busses, you also have the advantage that the various different FlexRay channels can be synchronized. Using the master channel, the slave channel will be synchronized with constant pre- or post-timing. A deterministic FlexRay routing in the gateway with hard real-time capability is thus ensured.

Along with FlexRay networks, the FlexXCon midget hardware also supports data transfers from a CAN to a FlexRay bus. In this way, ECUs based on FlexRay can be integrated into a CAN network and tested. The gateway specifications can then be defined via FlexConfig Gateway, in the same way as in a FlexRay network. The FlexXCon midget also works flexibly with numerous CAN and FlexRay channels.

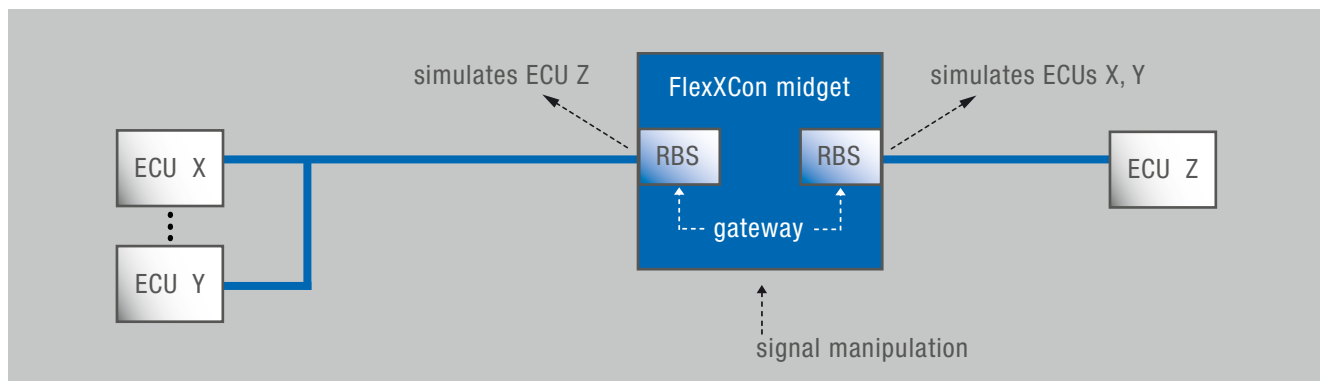


FLEXCONFIG CONTROL

SIGNAL MANIPULATION FOR ECU TESTS

In a system set-up with a newly developed ECU, the input as well as the output data must be modified for a test. Along with a gateway, for this purpose developers need to be able to manipulate specific signals. The FlexXCon midget provides you with the appropriate platform for this. FlexConfig Control software is the ideal solution for operating for this hardware. You can then modify the signal values and their time sequence using the clearly laid out, graphical user interface. This PC application also collects data from the RBS and the gateway configuration. The software also includes a comprehensive range of pre-defined manipulations: the user can

choose from the different signal manipulation options, which the FlexXCon midget hardware communicates directly to the data bus. But it is not just individual signal values that can be changed: the pre-defined functions also include ramp function specifications with rising or falling values, dynamic changes and scheduled adjustments for example. In this way, you can manipulate signals, delete them or create new ones, thereby simulating the unique testing conditions required for your ECU prototypes. Your developers can use this software and its many functions to influence ECU tests and therefore test the ECUs more effectively.

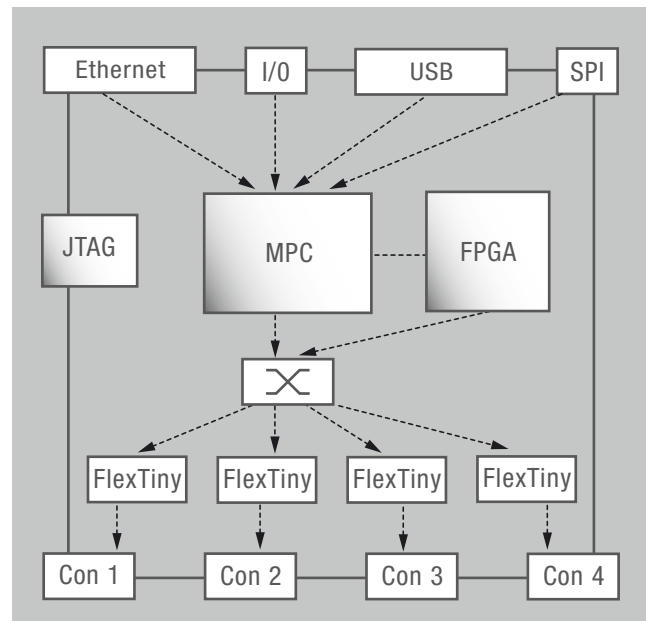


FLEXXCON MIDGET

UNIVERSAL HARDWARE PLATFORM

The ideal solution for comprehensive ECU tests: with the FlexXCon midget electronic platform, Eberspächer Electronics provides you with a high-performance piece of hardware that will support you in ECU prototype development. Its robust structure makes it perfect for test set-ups in laboratories as well as for tough testing conditions, such as in test vehicles. In combination with the FlexConfig RBS, FlexConfig Gateway and FlexConfig Control PC applications, you can implement numerous applications and also do this in different bus systems. FlexRay ECUs can also be easily integrated into an existing CAN environment. Additionally, the FlexTiny enables you to assign a specific data bus to each of the four isolated bus connectors on the FlexXCon midget.

The FlexXCon midget also comes with a set of tools that enables you to configure your own applications for ECU tests, gateways or rapid prototyping with the FlexXCon midget. These are programmed in ANSI C. Along with the program library, compilers, linkers and debuggers are also included for this purpose – all that you need for the necessary modifications to be carried out by your software developers.





The hardware's variable interfaces are designed for use in CAN, FlexRay and LIN networks. In order to provide conclusive results quickly during the development phase, the FlexXCon midget comes ready with sample applications. You can use the pre-defined functions to create your own applications: for this you simply connect the hardware to your PC using a USB port and Ethernet connection. There are also many other individual connection options using the wide range of cables available, which can be used to connect additional components to a network via the FlexXCon midget. When the system is being used in a test vehicle, if necessary, the hardware runs autonomous without a PC. Modifications of data or signals that have been defined in advance can be retrieved easily during a test via a switch signal. The hardware also comes with four digital I/O interfaces and five A/D converters.

With the FlexXCon midget, Eberspächer Electronics has developed a tool with the corresponding PC applications which covers all the requirements for gateways, remaining bus simulation and signal manipulation, and enables you to carry out comprehensive ECU tests – from prototype development to system integration in the tough conditions of vehicle testing.

Eberspächer Electronics has developed and produced various hardware platforms for the evaluation of FlexRay for numerous customer projects. This has resulted in a comprehensive portfolio of FlexRay products, which is continuously being expanded and improved. As a professional service provider with solid bus system know-how, we will support you with tailor-made engineering services, tools and test functions. Our services include the implementation of Eberspächer Electronics products in your systems and contract development projects for hard- and software in the area of bus systems.

Eberspächer Electronics – the experts in integration for FlexRay and more.

Eberspächer Electronics
GmbH & Co. KG
Robert-Bosch-Straße 6
73037 Göppingen, Germany
Phone +49 7161 9559-0
Fax +49 7161 9559-455
ebel-info@eberspaecher.com
www.eberspaecher-electronics.com

