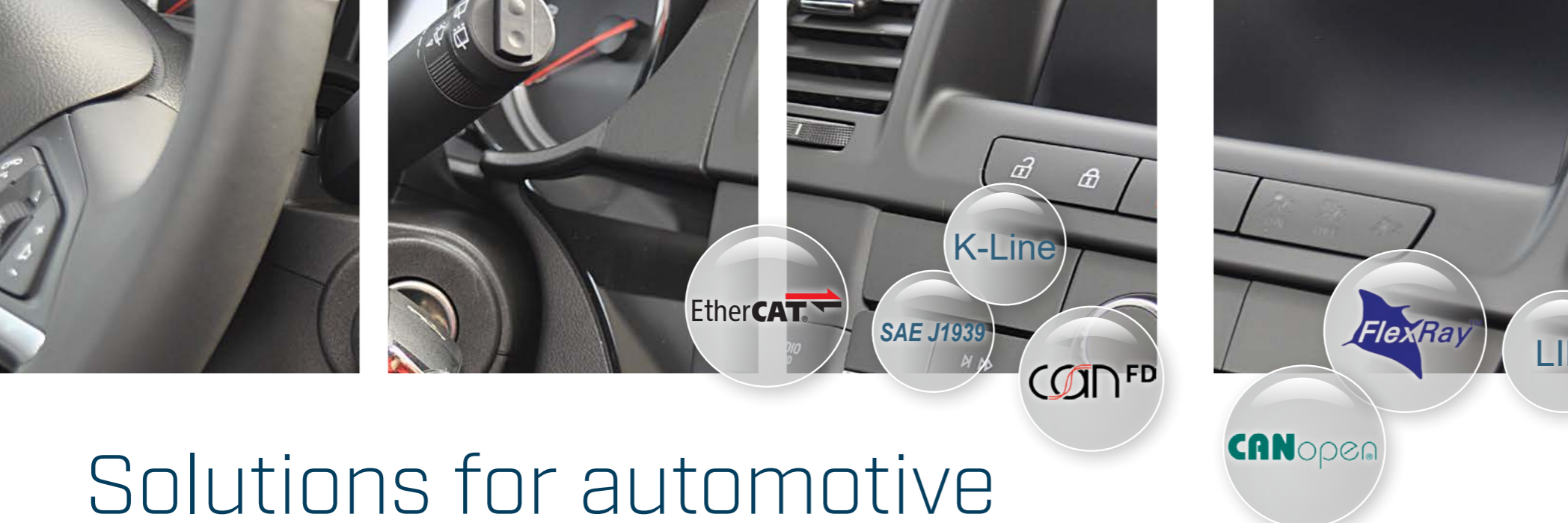# Ixxat®
BY HMS NETWORKS

Solutions for automotive test systems

Residual bus simulation
Gateways and PC interfaces
Data logging and visualization
Functional models (HIL, Matlab/Simulink)

HMS Connecting Devices™

Content

Solutions for automotive test systems

Modern vehicles are equipped with a variety of electronic components and control systems – reaching from the engine control unit to air bags and electronic seat adjustment. Communication between these systems is carried out using different standards – like CAN, FlexRay, LIN or others. Knowledge about these standards is key during development and testing of new electronic components for vehicles. HMS is experienced in all important automotive communication standards and offers proven solutions for testing networked systems and components in the "Ixxat Automotive" portfolio.

The versatile HMS solutions are used in many different areas:

HIL
- Communication with the device under test via residual bus simulation
- Signal stimulation/manipulation via standardized interfaces
- Connection of IOs via Ixxat gateways

The modular concept of the Ixxat automotive products enables easy adjustment to your individual requirements – both in terms of functionality and costs.

Thomas Waggershauser
Product Director for
Ixxat Products

In test benches
- Simulation of vehicle parts via RBS
- Simple connection to the test bench via a gateway solution
- Online data logging

For driving tests
- Scalable logging solution for all important vehicle bus systems – easy to configure
- Visualization of the data/signals – quick, clearly arranged and without programming

In test vehicles
- Easy integration of Electronic Control Units (ECU's) from various integration levels/OEMs
- Long-term recording of data
- Online visualization and parametrization

For crash tests
- Crash-safe, compact and powerful logging solution
- Triggering upon signals and/or impact detection event
- Ring buffer for pre/post triggering

Functional models
- Communication simulation via RBS
- Extension to functional simulation via Matlab/Simulink models
- Can be combined with logging and visualization

Customized
- Platform concept which allows for fast and cost-effective adaptation
- Supports all relevant protocols and standards
- Easy interface extension and software adaptation, also on behalf of customers

Embedded Platforms

The basis for accessing automotive bus systems

The Ixxat FRC Embedded Platforms form the basis for manifold testing and analysis applications – both with Ixxat automotive software tools as well as with customer-specific software solutions.

The embedded platforms have a powerful processor, a real-time operating system as well as a variety of different automotive communication interfaces.
They are therefore ideal for applications in which several bus systems are to be merged into a single device with its own processing power.
The PC is only needed for configuration or stimulation/visualization of data, as the actual intelligence – for e.g. the transport protocols – is outsourced to the embedded platform. Additionally, it is possible to implement stand-alone applications in order to, for example, combine several bus systems via a gateway in a vehicle without a control PC.
When using the Ixxat automotive tools, the required application-dependent functions can be activated on the device via runtime license.

Application areas

Test bench

In the test bench, vehicle parts such as the electronic power steering are frequently tested isolated from the vehicle. The communication interface should be installed close to the device under test, in order to minimize the interference in the bus topology.
In order to become operational, most ECUs also require a simulation of the – from their view – remaining vehicle bus.
The Embedded Platforms were designed for this use, both featuring a communication interface as well as a residual bus simulation in one device. Using the corresponding Ixxat tools, the platforms can be configured without own coding effort and can be placed directly at the device under test. The test bench computer is then connected with the platform across any distance.

Functional simulation

ECUs are sometimes required to respond to certain events in real time. PC's are often either too slow or not securely chronologically defined. In these cases, the intelligent embedded platforms can be used for functional simulations. Responses are promptly indicated and then forwarded to the PC – time-uncritically.

Analysis

The platforms can also be used for bus communication analysis. A simple use case is the pure interface function with a corresponding analysis software on the PC. However, the strength of the intelligent devices is the pre-processing of data.

Thanks to efficient pre-processing of data, it is possible to only send selected, physical signals from different bus systems to the PC for evaluation.
It is recommended to use Ethernet when connecting to the PC, since the measurement results then can be transmitted across long distances while being galvanically isolated and fail-safe. Other types of connections are also supported, such as USB or Wi-Fi.

Development platform

For most application cases, Ixxat offers the corresponding tools for platform configuration. Nevertheless, there are specific application cases where it may be necessary to create customized solutions.
The open platform architecture of Ixxat's solutions makes it possible to very quickly provide adaptations and extensions as well as fully customized solutions. If necessary, this can also be performed by the user alone using the software development kits.

Functions and interfaces	FRC-EP 170	FRC-EP 170 CAN-only	FRC-EP 190	FRC-Mobile
Interfaces				
FlexRay A/B channel, each 10 MBit/s	1 x	-	2 x (max.)	1 x
CAN High Speed	6 x (max.)	6 x (max.)	8 x (max.)	6 x (max.)
CAN Low Speed	1 x (max.)	1 x (max.)	2 x (max.)	1 x (max.)
CAN FD	2 x (max.)	2 x (max.)	4 x (max.)	2 x (max.)
LIN	1 x	1 x	2 x	1 x
K-Line	1 x	-	2 x	-
RS232	1 x	1 x	1 x	1 x
USB	2 x (Host and Device)	2 x (Host and Device)	2 x (Host and Device)	2 x (Host and Device)
Digital in	4 x	4 x	4 x (max.)	4 x
Digital out	4 x	4 x	4 x (max.)	4 x
Analog in (12 bit)	-	-	4 x (max.)	-
Further interfaces	-	-	optional EtherCAT-Slave I/O	-
Expansion Slots / Extensions				
SDHC card slot	1 x	1 x	1 x	1 x
Internal memory	-	-	-	32 GB
Internal expansion slots	2 x mPCIe form factor	2 x mPCIe form factor	2 x (FlexRay, CAN, CAN-FD, EtherCAT)	2 x mPCIe form factor
External extensions	Wi-Fi, USB devices	Wi-Fi, USB devices	Wi-Fi, USB devices	Wi-Fi
Others	Prepared: GSM/GPS, Bluetooth and Automotive Ethernet			
General				
PC connection	Ethernet 10/100 MBit/s, WLAN or USB 2.0			
Plugs	Standard plug for PC; DSub plug for fieldbus			30 and 48 pin SHS plug
Temp. range	-40 °C ... +80 °C			
Protection class	IP42	IP42	IP42	IP67
Power supply	6-36 V DC; 350 mA typ. at 12 V	6-36 V DC; 350 mA typ. at 12 V	6-36 V DC; 420 mA typ. at 12 V	6-36 V DC; 350 mA typ. at 12 V
Dimensions (mm)	142 x 113 x 40	142 x 113 x 40	182 x 113 x 50	190 x 180 x 60

Automotive Configuration Tool

Embedded Platform + ACT = Versatile Solutions Enabled

The embedded platform only provides the processing power and the desired interfaces in an automotive-suitable form factor. A total solution is achieved when a corresponding configuration has been created for these devices. For this purpose, HMS offers the Automotive Configuration Tool, ACT – a powerful, yet easy to use PC software with versatile functions and possibilities.

IxAdmin

The IxAdmin is the administration tool for the connected embedded platform. With the IxAdmin tool, created configurations can be loaded on the device, updates can be performed, runtime licenses can be managed and basic settings can be made. The IxAdmin can be connected to the device via USB, Ethernet or Wi-Fi.

Vehicle Editor

The basis for most solutions in the automotive sector are bus descriptions in CANdB, FIBEX or AUTOSAR-XML format. The bus descriptions contain a great deal of information, but often not all required information. Using the Vehicle Editor, everything that belongs to a certain vehicle, an integration level or a test configuration can be easily combined. This data can then easily be accessed during further configuration.

RBS

Residual bus simulation

The residual bus simulation view of the ACT tool provides a simulation environment for one or more ECUs in order to test these independently of other network devices. This includes, for example, generation of the necessary communication traffic as well as automatic calculation of signal-based CRCs and alive counters. Without programming effort and supported by a configuration wizard, the user is guided through a few, logical graphical configuration steps of a residual bus simulation. The generated function module is autonomously executed on the embedded platform.
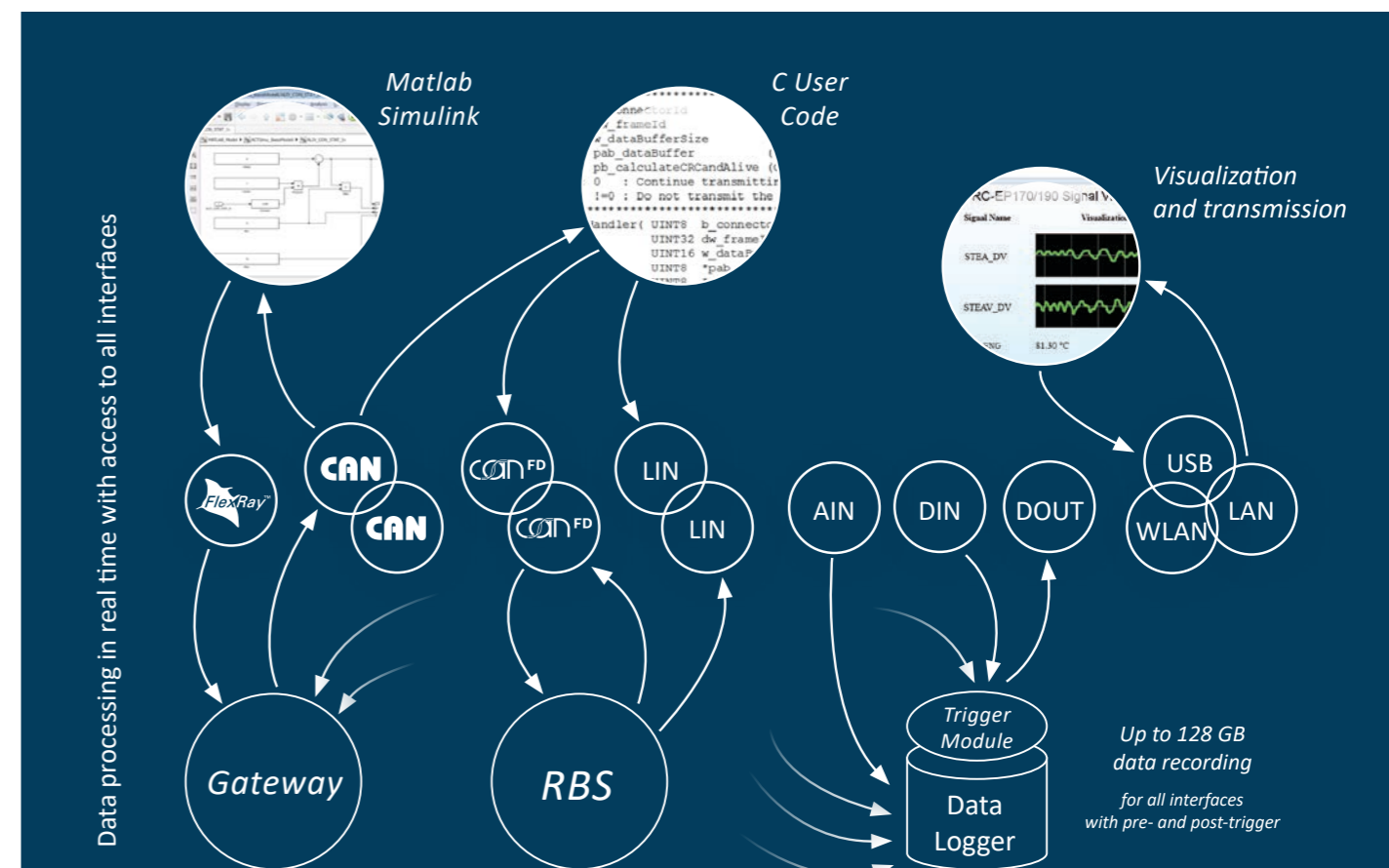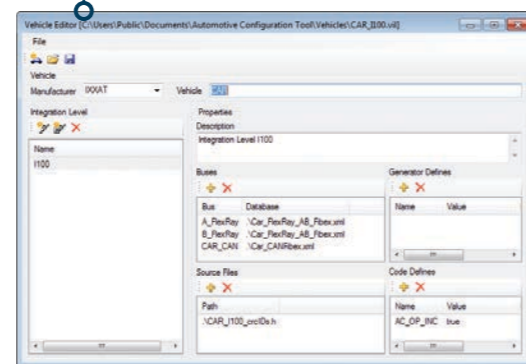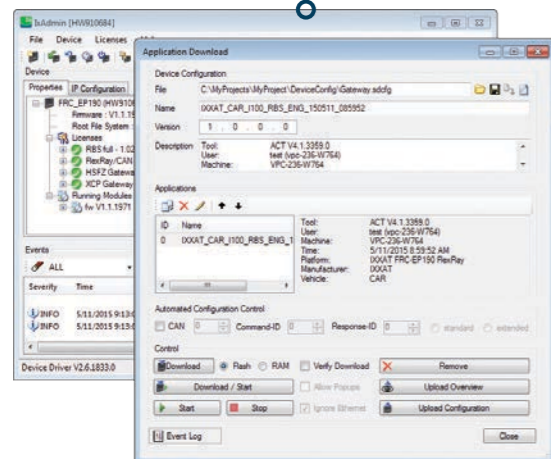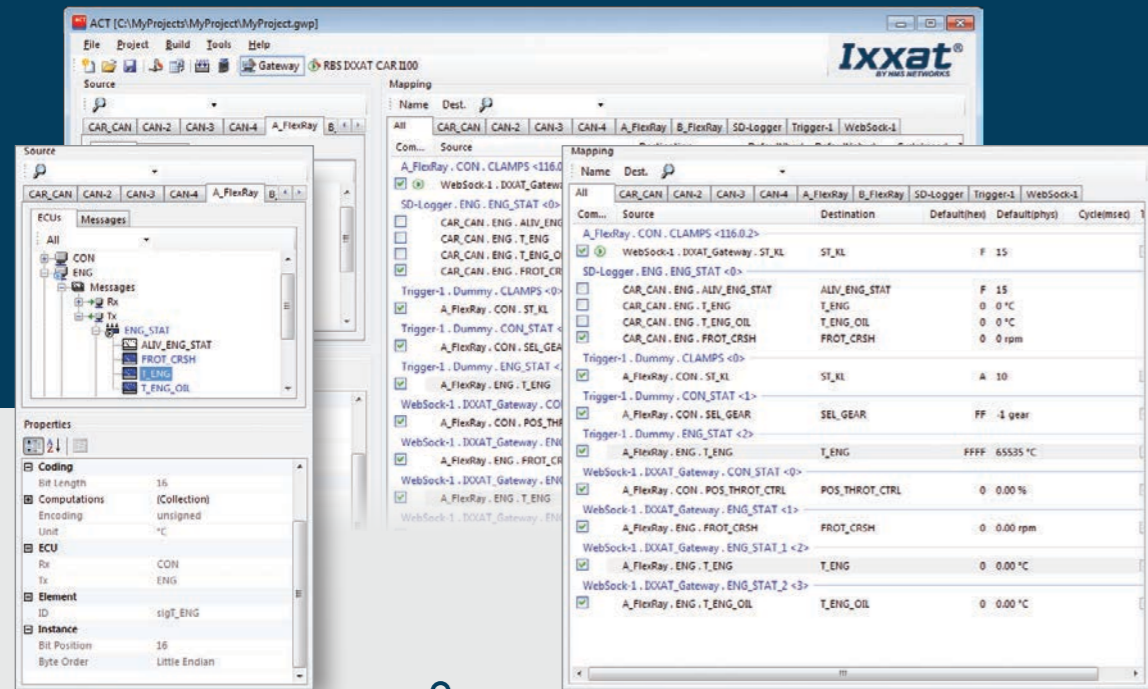
XCPonEthernet

With the XCPonEthernet solution, it is possible to control the residual bus simulation via a standardized protocol and to evaluate communication data. For this purpose, all signals of the CANdb and/or FIBEX file are merged in a A2L file. The A2L file can then be imported into suitable software solutions, enabling representation of all signals present on the bus and to influence all signals sent by the residual bus simulation.
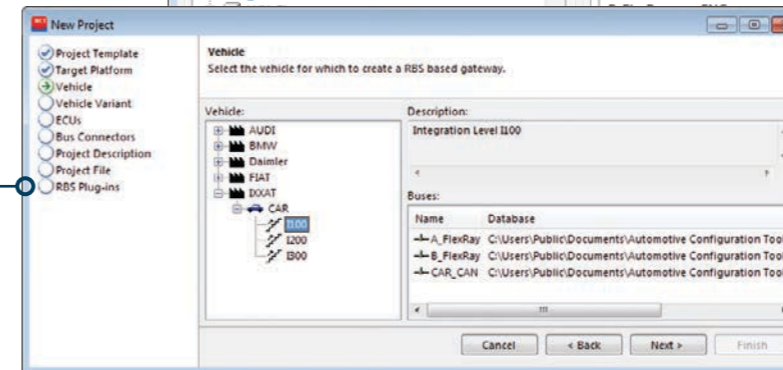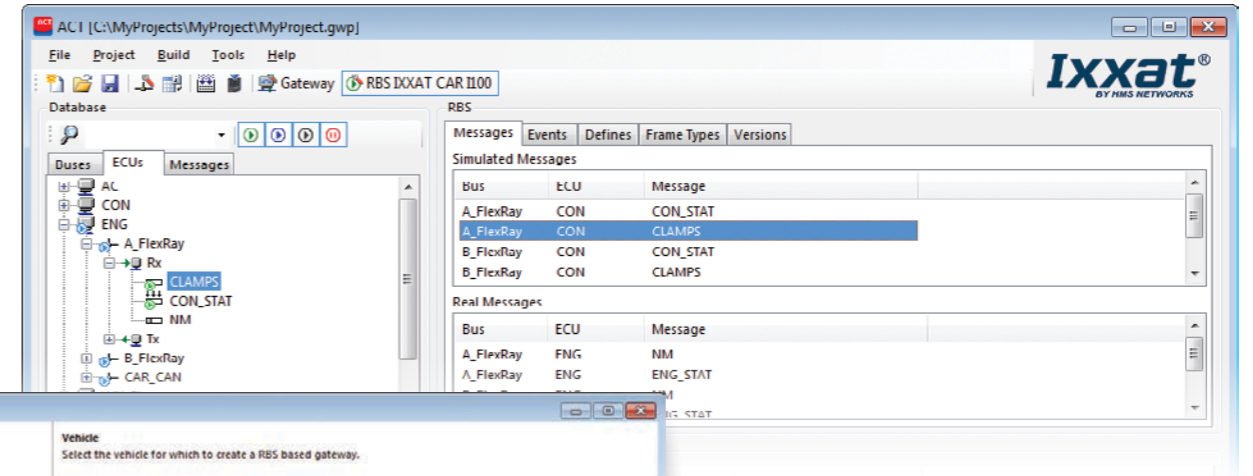
HIL signal manipulation

Based on the FlexRay/CAN residual bus simulation and the XCPonEthernet extension, the signals sent by the RBS can be defined and manipulated. This includes, for example, on/off signal switching for a defined time/number of cycles, transmission of defined substitute values with switched-off signals and defined corrupting of CRCs and alive counters for all signals sent by the RBS. Signal manipulation control can be done via user code, the gateway or XCPonEthernet.

Data processing in real time with access to all interfaces

Matlab Simulink

C User Code

Visualization and transmission

FlexRay — CAN / CAN — CAN FD / CAN FD — LIN / LIN — AIN — DIN — DOUT — USB / WLAN / LAN

Gateway — RBS — Trigger Module — Data Logger

Up to 128 GB data recording

for all interfaces with pre- and post-trigger

Gateway

Like the residual bus simulation, the gateway configuration is another view of the ACT tool. The gateway is a versatile solution, which can be used alone or in conjunction with a residual bus simulation to combine different data streams with each other, regardless if physical or virtual bus systems are being addressed.
The gateway view of the ACT tool is divided into two areas: source and target. Regardless of bus system handled, messages or individual signals from the source to the target bus are always mapped in the same way via drag & drop. The created configuration can be loaded on an Ixxat embedded platform and executed stand-alone.

FlexRay / CAN / CAN FD / LIN

A bus description file can be provided for these physical bus systems. With the signal-based gateway, it is therefore possible to combine signals from different source messages into one target message. In the process, send

triggers and possible default values can be freely chosen. If the source signal description and the target signal deviate from each other, an optional signal transformation could take place automatically, in order to ensure that the interpretation of the source and target signal is identical. It is also possible to adapt the cycle times of the sent messages to relieve the recipient connected to the target bus.
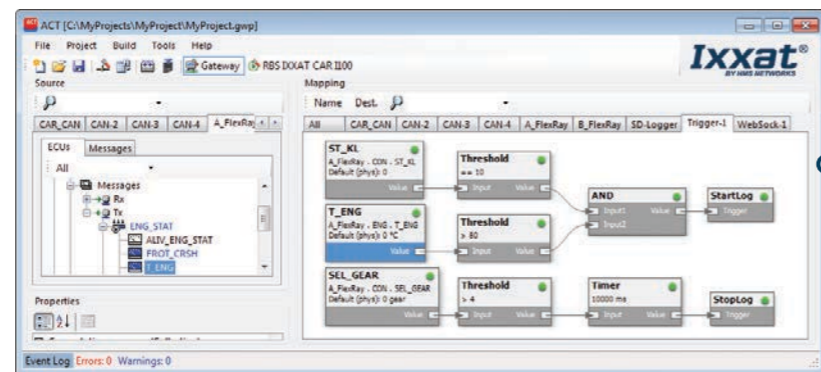
Analog / Digital IO

Different IOs are available, depending on the embedded platform used. These can be added to the gateway as

a virtual bus. After configuring the data direction, the range of values, the conversion rule and the unit, the IOs can be mapped similarly to the other bus systems via drag & drop. This makes it possible to map the trigger inputs and outputs of the logger or to fill vehicle signals based on the analog inputs.

Signal and data logger

The logger is added to the gateway configuration as a virtual bus. Signals and messages to be recorded can be mapped on the logger bus via drag & drop, similar to the other bus systems. In addition, it is possible to define and

to graphically configure trigger inputs on a signal basis. Optionally, a ring buffer can be configured to enable recording of data to the storage media which was received before the trigger event. Recording then takes place on a common time basis for all connected bus systems. Depending on the application, different SDHC card recording formats can be chosen. The logger can be used individually or in parallel to a residual bus simulation. Recordings can also be played back again later in the correct chronological order.

Generic Ethernet

In addition to the CAN interfaces installed in the device, the Ixxat FRC Embedded Platforms have up to 16 „virtual CAN on Ethernet" buses. An Ixxat protocol is used here, which allows for the receipt and transmission of messages from and to 16 different IP addresses. For each virtual CAN bus, the ACT generates a CANdB bus description file, which the remote station can use to interpret the data stream, similar to a real CAN bus. Depending on the requirement, a virtual CAN channel can be evaluated by the control PC, analyzed with the Ixxat canAnalyser or transformed to CAN again via an Ixxat CAN@net.

EtherCAT

The FRC-EP190 comes with an Ether-CAT extension in order to combine the automotive world with the industrial world in the test bench. With the ACT

tool, the signals from the vehicle or ECU can be selected, which are to be analyzed or stimulated via EtherCAT. The EtherCAT configuration can be read directly from the device.

FDX

The Fast Data Exchange protocol is an Ethernet-based communication interface and represents a favorable alternative to XCPonEthernet for accessing physical signals. FDX does not require an elaborate communication stack and can therefore be quickly implemented on any target platforms. For the FDX interface, the ACT generates an XML description file that can be used for the interpretation of the data stream.

Signal visualization

The signal visualization is added to the gateway configuration as a virtual bus. Using the integrated web server, it allows a simple display and stimulation of all mapped signals. Any device (PC, smartphone

or tablet) can be used here as a display device. The basic requirement is only a HTML5-capable web browser. HMS provides a generic HTML page for this purpose, which can be adapted by the user to own needs. The visualization device is connected via USB, Ethernet or Wi-Fi.
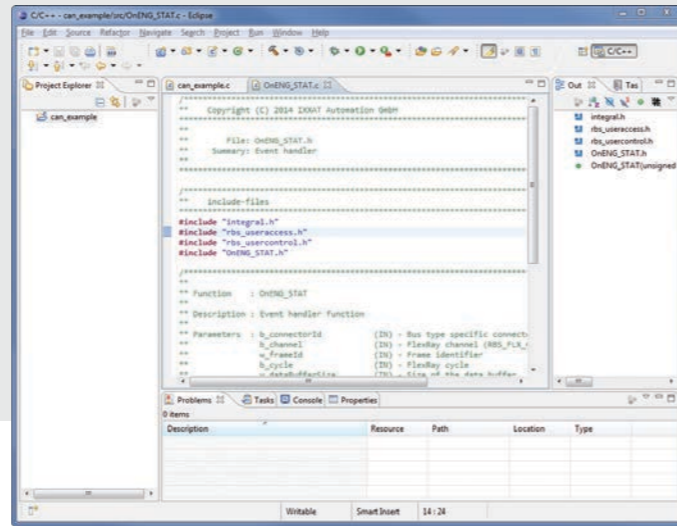
User code

In addition to the various possibilities of the standard gateway solution, it is possible to implement own, specific functions. For this purpose, the user code bus is added as a virtual bus of the gateway configuration. Signals or messages that are mapped via drag & drop from and to all other bus systems serve as an input/output for the own code. The user code application is written in standard C and may represent specific algorithms. Digital output control as well as implementation of a complex logger trigger module is therefore possible.
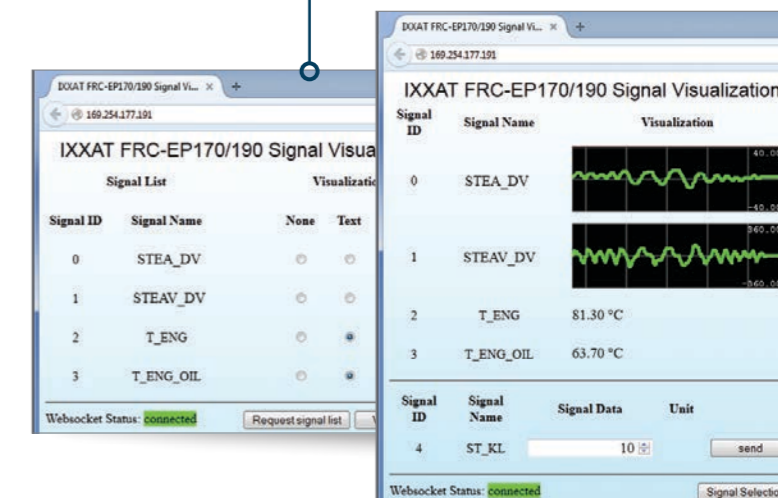
Functional models

For some users, C code development is either too complex or there are already finished models from other projects. It is possible to integrate such models using an own API. Similar to the user code, a Matlab/Simulink model can then access the mapped signals and messages, making it possible to integrate also complex functional models.

Development tool

An Eclipse-based development environment is available for development of own, specific applications. This is either available independently or integrated in the ACT tool. Through the development environment, the user code applications can be developed to extend the gateway solution

or completely separate applications can be created. This is supported by the integration into the ACT project, the convenient editor, cross-compiler as well as a high-level language debugger. The applications developed in this way can be executed stand-alone on the Ixxat embedded platforms.

canAnalyser

Powerful and versatile tool for development, test and maintenance of CAN, CANopen, CAN-FD, SAE J1939 and LIN systems

The canAnalyser is based on a modular concept which makes it open and expandable.
The standard version of canAnalyser has functions that cover many application areas such as:

■ Transmission of single messages, signals and message sequences
■ Reception and interpretation of messages and signals
■ Display of statistic data
■ Signal management with databases – Editing via editor or import (CANdb, FIBEX, DIM)
■ FIBEX and CANdb file export

The canAnalyser is based on the VCI driver and can be used with all Ixxat interfaces.
Additional functions are provided by optional modules, such as the protocol-specific display of messages in CANopen or J1939 systems. Customized functions can be added by using the open .NET programming interface.

More information can be found at
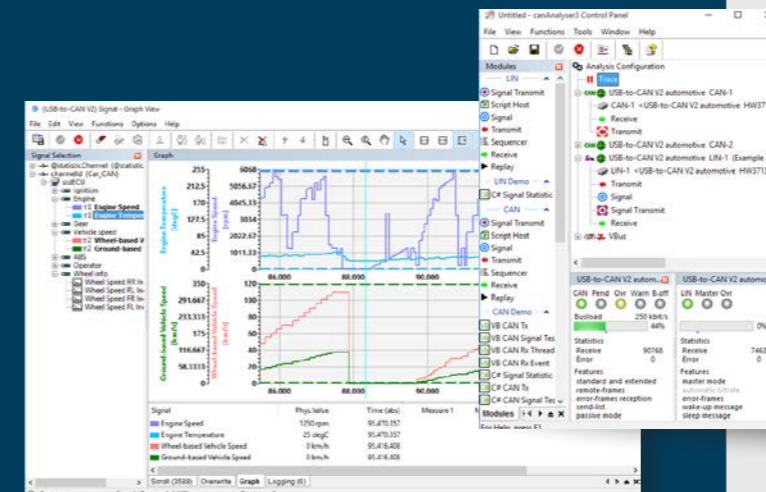www.ixxat.com/canAnalyser
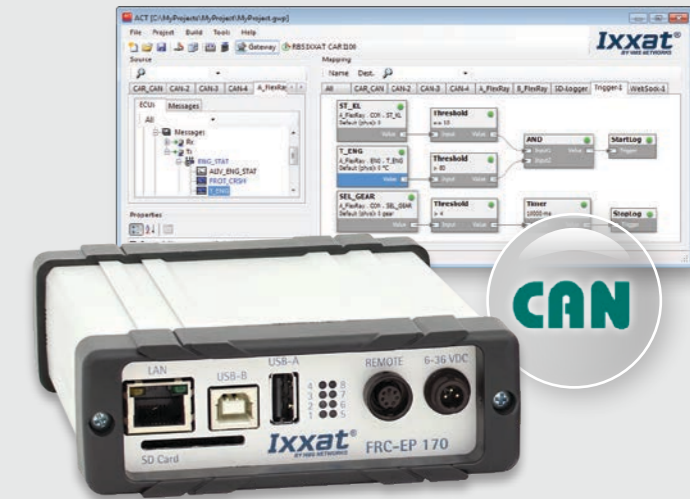
Data logger for CAN

Cost-effective logging solution for CAN, CAN FD, LIN and FlexRay (optional)

The Ixxat data logger for CAN is based on the powerful FRC platform and can be easily configured with the free version of the ACT tool.

■ Simultaneous recording of up to 8 CAN channels (4 x CAN FD), LIN and 4 digital inputs (optional FlexRay)
■ Recording of all connected bus systems with a uniform time base
■ Easy configuration via drag & drop of messages/signals or complete buses – with support of CANdb, DBC and Fibex files
■ Graphical trigger configuration with pre and post trigger (ring buffer)
■ Fast boot time
■ Recording on SD card, USB stick or USB hard disk (CSV, MDF4 or binary)
■ Data visualization via Web-socket with HTML5 capable devices (tablet/PC) using USB, LAN or WLAN
■ Easy upgrade from data logger to gateway

Solution	FlexRay/CAN RBS	Gateway	Development tool	Data logger
Description	Residual bus simulation for FlexRay and CAN based systems on Ixxat Embedded Platforms	Universal application for message/signal conversion on the Ixxat Embedded Platform	Development environment for the implementation of specific requirements on Ixxat Embedded Platforms	Application for configuration of the embedded platform as data logger
Functions	Generation of FlexRay and CAN messages as well as reaction to messages received	Message or signal conversion between all bus systems on target hardware	Eclipse-based development environment	Message/signal conversion from all bus systems/IOs to the memory
	Provision of two cold starter nodes for starting up a FlexRay system	Support of FDX & EtherCAT	Application development for Linux User Mode	Pre- and posttrigger
	PC controlled and stand alone operation	Easy allocation of signals from the source to the target bus via drag & drop	Cross compiler for Ixxat Embedded Platforms	Graphical configuration of trigger conditions
	Easy configuration based on data of the bus description files	Optional automatic signal conversion	Remote debugging via Ethernet or USB	Drag & drop assignment of signals from source to destination bus
	Signal manipulation for all signals transmitted by the RBS	Matlab/Simulink support	High-level code debugging	Plausibility and consistency check of the configuration
	Stimulation via XCPonETHERNET and commercial third-party software	Automatic plausibility and consistency check of the configuration	API for connecting your own application to the Ixxat residual bus simulation	Signal visualization on HTML5-capable devices (e.g. tablet or PC)
		Signal visualization on HTML5 capable devices		Logging to SDHC card or USB storage media in different formats
		Logging to SDHC card or USB storage media in different formats		DBC and Fibex compatible
		Expansion by C user code or functional models		Expansion by C user code or functional models
Software version	chargeable	chargeable	chargeable	free

PC Interfaces

for analysis and control of CAN, CAN-FD, FlexRay and LIN systems

Ixxat PC interfaces are used in a wide range of applications, either in test benches to connect devices to be tested to a test computer or as control interface in production systems.

Easy integration into customer applications

Powerful drivers for Windows, Linux and real-time operating systems are included with the PC interfaces, enabling an easy integration. A uniform programming interface for all CAN interfaces allows quick switching between cards without adaptation of the customer application. Thus, it is easy to select the the best CAN interface depending on application, performance requirements or costs.

Windows

The "Virtual Communication Interface" (VCI) driver for Windows is designed as a system server and allows simultaneous access by several applications to one or more CAN controllers of one or more PC interfaces. The driver supports 32 and 64 bit Windows operating systems and includes a simple CAN bus monitor "canAnalyser Mini".

User interfaces:
- C, JAVA and LabView API
- DASYLab (includes Ixxat driver)

- .NET API for integration into Agilent VEE, C#, Visual Basic .NET
- LabWindows

Linux & Real-time OS

For use of the CAN interfaces with Linux, QNX, RTX, INtime and VxWorks Ixxat provides the universal "Embedded Communication Interface" driver (ECI) free of charge. The ECI driver has a C-based application interface.

SAE J1939 and CANopen

For use of the CAN interfaces with CANopen or J1939, HMS offers driver APIs that provide all protocol specific functions and thus enable quick and easy development of PC-based control and configuration applications.

Product	CAN-IB600 /PCIe	CAN-IB120 /PCIe Mini	USB-to-CAN V2 Automotive	USB-to-CAN FD Automotive	CAN@net II/VCI	CANblue II	FR-IB100 /PCIe
PC interface	PCI express	PCIe Mini Card	USB	USB	Ethernet	Bluetooth (V2.1)	PCI express
Fieldbus interfaces	1-2x CAN / CAN FD	1/2x CAN	2x CAN (HS/LS) 1x LIN	2x CAN/CAN-FD 1x LIN	1x CAN	1x CAN	FlexRay
CAN bus interface	ISO 11898-2	ISO 11898-2	ISO 11898-2; switchable to ISO 11898-3	ISO 11898-2	ISO 11898-2	ISO 11898-2	2x 10 MBit/s
CAN connection	Sub D9 plug (CiA 303-1)	Cable with open ends	RJ45 with Sub-D adapter	RJ45 with Sub-D adapter	Sub D9 plug (CiA 303-1)	Sub D9 plug (CiA 303-1)	Sub D9 plug
Galv. iso.	1 kV, 1 sec.	optional	1 kV, 1 sec.	1 kV, 1 sec.	1 kV, 1 sec.	1 kV, 1 sec.	yes

More products can be found at www.ixxat.com/can-interfaces

Repeaters, Bridges & Gateways

for test back-ups and system extension

Ixxat repeaters, bridges and gateways are used in many application areas, for system extension, protection and control of noise.

CAN repeaters

Ixxat CAN repeaters are specially designed for use in an industrial environment, meeting the highest demands in terms of robustness, temperature range and safety. Users can benefit from significantly improved system reliability along with cost-savings thanks to simpler wiring.
The CAN repeaters are used to establish a physical coupling of two or more segments of a CAN bus system. They can be used to implement tree or star topologies as well as for long drop lines. In addition, network segments can be electrically decoupled using a galvanically isolated repeater.

CAN bridges and gateways

The use of Ixxat bridges and gateways opens up a large number of possibilities. For example, CAN systems can be implemented with a larger system expansion or systems can be coupled using different communication technologies, like Bluetooth or Ethernet.
CAN bridges can link two or more CAN networks that employ different CAN bit rates or protocols. Translation and filter rules can also be used.
As an extension to the CAN bridges, CAN gateways allow access to CAN networks using other communication systems, e.g. Bluetooth or Ethernet.

Product	CAN-CR200	CAN-CR210/FO
Description	Stackable ISO 11898-2 CAN repeater	Stackable ISO 11898-2 to fiber optic converter
CAN bus interface	2x ISO 11898-2; DIN rail bus	1x ISO 11898-2; DIN rail bus
CAN con.	SUB D9	
Integr. CAN termination	Switchable	
Galvanic isolation	CAN 1 / CAN 2 1 kV, 1 sec.	CAN1 - PWR 1 kV CAN 2: Fiber-Opt.
LWL connection	-	F-SMA or ST (fiber optic 50/ 125 µm duplex)

Product	CANbridge NT 420	CAN@net NT 420	CANblue II
Description	Bridge/Router for CAN and CAN-FD	Gateway and Bridge for CAN/CAN-FD to Ethernet	CAN/Bluetooth Gateway, Bridge and PC Interface
Application field	Extension of the network dimension and network segmentation	CAN connection via Ethernet as well as CAN-Ethernet-CAN bridge	Wireless CAN connection of Windows, Linux or emb. applications
Functionality	Filtering, Identifier conversion, Baudrate conversion, CAN/CAN-FD conversion		Message filtering
Fieldbus interf.	4 x CAN (2 x switchable to CAN-FD)		1 x CAN
CAN bus interf.	ISO 11898-2	ISO 11898-2	ISO 11898-2
CAN con.	Screw terminals	Screw terminals	Sub D9 plug
Further interfaces	-	10/100 MBit/s, RJ45 socket	Bluetooth
Galv. isolation	yes	yes	yes

More products can be found at www.ixxat.com/bridges

Third-party products

Ixxat Automotive products from HMS are used in various third-party products

CanEasy

CanEasy is a software-based residual bus simulation and analysis tool for CAN and LIN, which supports all VCI driver based interfaces from Ixxat. In conjunction with the FRC devices, FlexRay data can be easily stored and displayed.
With CanEasy, residual bus simulations can be configured quickly, automatically and flexible, also offering add-ons for XCP and diagnostic functionality. In addition, an integrated development environment is available for VBA or .NET. Sophisticated and clear user interfaces can be easily designed by using rich panels.

A free trial version is available at www.caneasy.de
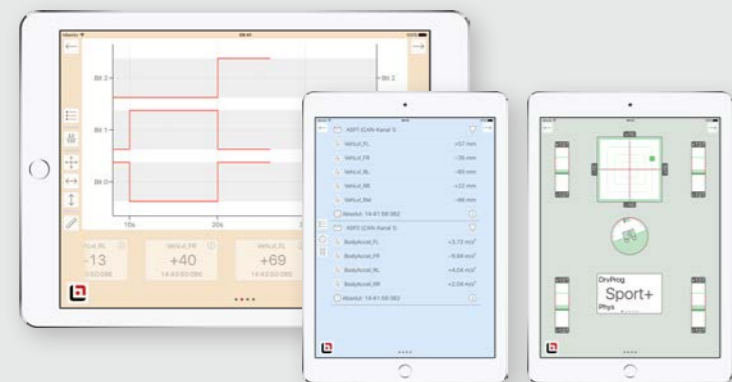
hibento app

The hibento app allows easy visualization and manipulation of CAN and FlexRay data, provided by the Ixxat FRC Embedded Platforms via WLAN.
The app supports DBC and Fibex description files and displays the data within graphical instruments, as trace, and as scope.

A free demo version is available on request.

More products can be found at
www.ixxat.com/automotive

Customized solutions

The three solution levels

Level 1:
Software adaptation of an existing Ixxat product

For a customer project, CAN signals in a vehicle had to be converted to digital frequencies. This was necessary in order to adapt a new CAN-based engine technology for commercial vehicles to our customer's solution. In the first approach, the customer had selected the standard CANio250 in the PCB version. During consultation it was concluded that the requirements could not be mapped with the standard firmware of the device. Based on the CANio ADK (application development kit), a customized firmware was developed which is programmed into the devices before delivery to the customer.

Level 2:
Hardware adaptation for an existing Ixxat product

Specific device requirements from a customer were met by customizing the FRC-EP170 motherboard with regards to interface compilation and pin assignment. The housing color and design was also modified according to the customer's specification.

Level 3:
Completely customized product

After having provided the display device AZG 2000 to ZF Friedrichshafen AG for several years, HMS created the successor device AZG3000 through a customization project. Downward compatibility was very important, and HMS managed to represent the functional range of the AZG2000 model also in the new AZG3000 device.
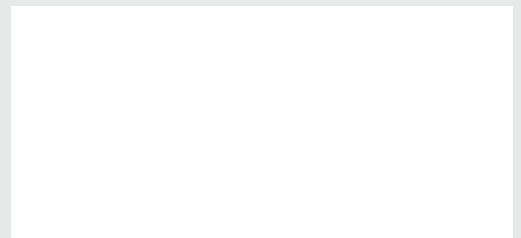
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HMS Networks - Contact

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Find your nearest contact here:

www.hms-networks.com/contact

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