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ASAM SOLUTIONS GUIDE

STANDARDS I MEMBERS I PRODUCTS

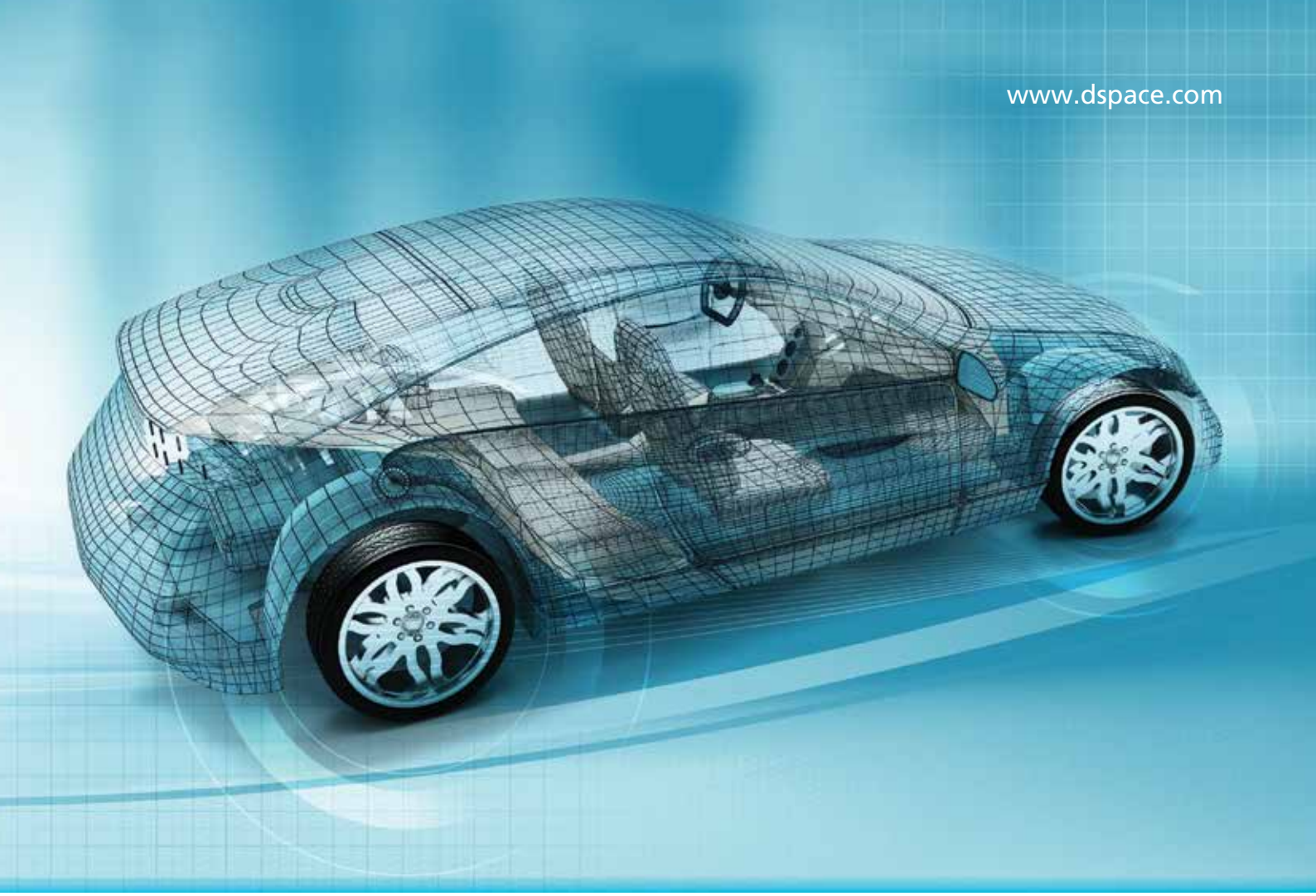
ASAM SOLUTIONS GUIDE

ISSUE 7

ASAM

ASAM | Association for Standardisation of Automation and Measuring Systems

www.dspace.com



ASAM MEMBER

ReqIF

AUTOSAR

CAR 2 CAR COMMUNICATION CONSORTIUM

FMI

OPEN ALLIANCE

ISO 26262

ADASIS Advanced Driver Assistant Systems Interface Specifications

dSPACE Technology: Setting Standards

Higher expectations regarding safety, comfort, and environmental compatibility are rapidly pushing up the complexity of electronic systems. Standards help to bring state-of-the-art technology into a broader market and save cost.

As an innovation leader, we at dSPACE have always committed to standards by being an active member in several standardization groups, implementing standards throughout our sophisticated products, and supporting customers to follow standards in their development processes.

Being in constant demand by all major automobile manufacturers and suppliers, dSPACE never stops helping you do new things successfully, save your investments and be ready for the challenges of the future. How do we do that? With our know-how, software and hardware, and the dedication of over 1.200 employees.

Accelerate your success – with dSPACE!

Embedded Success dSPACE

Hans-Georg Swolana
Chairman of
Board of Directors,
ASAM e.V.

Dear Reader,

We are happy to present the 7th edition of the ASAM Solutions Guide, the official directory of ASAM standards, ASAM members and ASAM related products. In the past years, this guide has been a companion for members and people interested in ASAM standards alike. It will give you a comprehensive overview on ASAM standards, their usage and ASAM compliant products.

When we started the production of the ASAM Solutions Guide in 2006, we had 113 members. Today, we count 151 members. We are proud of this growth, as it teaches us that standardization is an important issue. Companies worldwide are looking for solutions that help them to integrate tools (plug and play), to connect software applications and to allow a seamless data exchange.

ASAM is a strong partner for standardization. We have succeeded in providing a standards portfolio that many companies trust in and rely on. We will continue to support standardization projects in the future: I am particularly proud that in 2014 four new standardization project groups have started. The hiring of a Business Development Manager who will analyze market trends and evaluate their standardization potential will significantly enhance ASAM capabilities to the benefit of all, ASAM members and users.

We know that all achievements are only possible with the help of our members: their cooperation, their ideas, their initiative, and their excellent development work. We would like to thank our members for their support and their trust in ASAM and encourage all those who are not members yet, to become part of this active and innovative community.

Sincerely,

Hans-Georg Swolana
Chairman of the Board of Directors
ASAM e.V.

ASAM MEMBERS

OEM MEMBERS

Audi, BMW, DAIMLER, FORD, GM, HINO, HONDA The Power of Dreams, MAN, NISSAN MOTOR CORPORATION, OPEL Wir leben Autos., PORSCHE, PSA PEUGEOT CITROËN, SAIC 上汽集团 SAIC MOTOR, TOYOTA, VOLKSWAGEN, VOLVO

TIER-1 SUPPLIERS

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SUPPLIERS

A&D Company, Limited, A&S SOFTWARE GMBH, ATI, Aimagin, AMS, ARC The future is open CORE, autient, AVL, b-plus, BASELABS, RAINFE 瑞风协同, DIGITEST 天健通泰科技, BERNER & MATTNER AN ASSYSTEM COMPANY, BETA CAE Systems SA, Brüel & Kjær, C.L.GERHARTL Smart Systems, CAETEC, carts, cbb software GmbH, MORE AUTOMOTIVE, Cognitran, CONTROLTEC UNLOCKING THE POWER OF DATA, cpac TAKING CONTROL FORWARD, CSM Die Messtechnik., D2T, DSA, dSPACE, DSG UK Engine & Component Test Systems, ESR LABS, Eberspächer, emotive, ESTEREL Technologies, ETAS, FEV, GIGATRONIK, nCode an HBM brand, HEAD acoustics, HGL Dynamics, HighQSoft, HORIBA Automotive Test Systems, iAVL, ICS, imc, influx TECHNOLOGY, INTEMPORA, IntrepidCS, IPETRONIK, IPG, ISTEC, IXXAT, KGC, KISTLER measure. analyze. innovate., KPIT, kratzer AUTOMATION, KRISTL, SEIBT & CO, mk, AIP Automotive Industry Products MAHA, MathWorks, measX Measurement System Experts, MEIDEN, MFP, MÜLLER-BBM VibroAkustik Systeme, NATIONAL INSTRUMENTS, ONO SOKKI, ORME Signals & Images, PTC, PEAK SOLUTION, PEAK System, PIKETEC, Polytec, QTronic, RA CONSULTING, rd, ReliaTec, RENK Test System, samtec automotive software & electronics, H.-J. Schleicher Soft- und Hardware Entwicklung GmbH, sc science + computing, SGE, SIEMENS, SIERRA CP ENGINEERING, SIMTOOLS, sodius, softing Automotive Electronics GmbH, sontheim Industrie Elektronik GmbH, SOUNDTEC, STIEGELE Datensysteme GmbH, Synchrotek Science on board, TESIS DYNAware, TOYO Corporation, tracetronic, TTTech, vector, ViGEM VISIONS GO EMBEDDED, VISUIT!, WEISANG, white pine, WIND HILL, X2E embedded system design, xioworks, YOKOGAWA Yokogawa Digital Computer Corporation

ACADEMICS

b-tu Brandenburgische Technische Universität Cottbus, MŰEGYETEM 1782, virtual vehicle, Fachhochschule Köln, RWTH AACHEN UNIVERSITY OF APPLIED SCIENCES, Ostfalia University of Applied Sciences, FZI, Hochschule für Angewandte Wissenschaften Hamburg Hamburg University of Applied Sciences, HHN Hochschule Heilbronn, HOCHSCHULE TRIER, HTW, ika INSTITUT FÜR KRAFTFAHRZEUGE RWTH AACHEN UNIVERSITY, Technische Hochschule Ingolstadt, vkm, IAD, UNIKASSEL VERSITÄT, Universität Stuttgart, ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA

Table of Contents

ASAM PROVIDES A STANDARDS PORTFOLIO THAT MANY COMPANIES TRUST IN AND RELY ON. IN 2014, A NUMBER OF ACHIEVEMENTS HAVE BEEN ACCOMPLISHED:

ASAM started the development of four new ASAM standards

In addition to its existing 22 standards ASAM has launched four new projects that will further complement the current portfolio. The first two projects below provide the foundation for an entire new class of tools in our industry. The project "Extension of OTX" was proposed to ASAM because our members appreciate the efficient platform of ASAM for standard development.

- **ASAM MCD-2 CERP**
  (Data Description for Calibration Expert Systems)
  This project aims to standardize the description of dependencies between calibration parameters allowing interdisciplinary teams to document and use this knowledge for the calibration of embedded systems.

- **ASAM CSL** (Calibration Sequence Language)
  This new standard will define the semantics and exchange format of a language for the description of calibration processes. The standard allows that the IP of how to calibrate an ECU is captured in a vendor-independent language.

- **ASAM POD Access**
  This project aims to standardize the configuration of POD-adapters (plug-on device) of a calibration system and their software interface toward the ECU (electronic control unit). The standard will ease the integration of different PODs in one ECU, or will ultimately allow changing PODs without any changes in the ECU's software.

- **Extension of OTX (ISO 13209)**
  ASAM develops additional functionality for the ISO OTX standard. Although an ISO standard, the development for the OTX extension is carried out within the ASAM organization. The results will then be transferred to ISO to be included in ISO 13209 part 4.

These initiatives demonstrate that there is a need for further standardization in the industry. In order to take innovative and visionary standardization forward, ASAM intends to hire a Business Development Manager who will analyze market trends and standardization potential across company borders.

ASAM has further improved its member communication and how members can get involved at ASAM

One major goal of ASAM is to increase member involvement both by providing better transparency on current ASAM activities and offering opportunities to participate. Processes have been set up that enable all members, whether in or outside of Germany, 'newbie' or 'veteran', to participate in the standardization process.

1. **Email alerts that Call for Participation:** All members may comment on project proposal and/or subscribe to upcoming work groups.

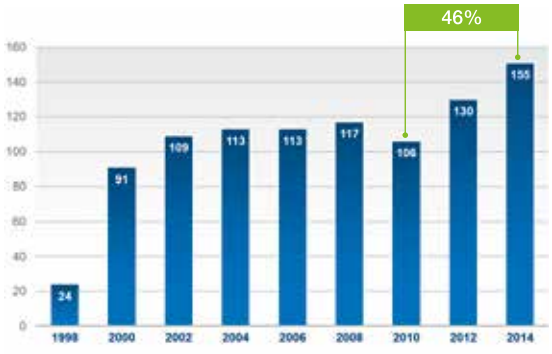
2. **Status Updates on the ASAM website:** Members can get an update on the current status of ASAM projects at any time (www.asam.net/projects.html).

3. **Email alerts that Call for Public Review:** Some work groups have decided to carry out a public review for a new or revised standard before release. This process will make sure that the new standard is useful, complete, implementable, free of errors or ambiguities and will not interrupt processes.

These processes require an increased email frequency. If you feel that the volume has increased too much, it is recommended to update your preferences in your next newsletter (see footer of your next email). This will limit the email traffic to the topics of your interest.

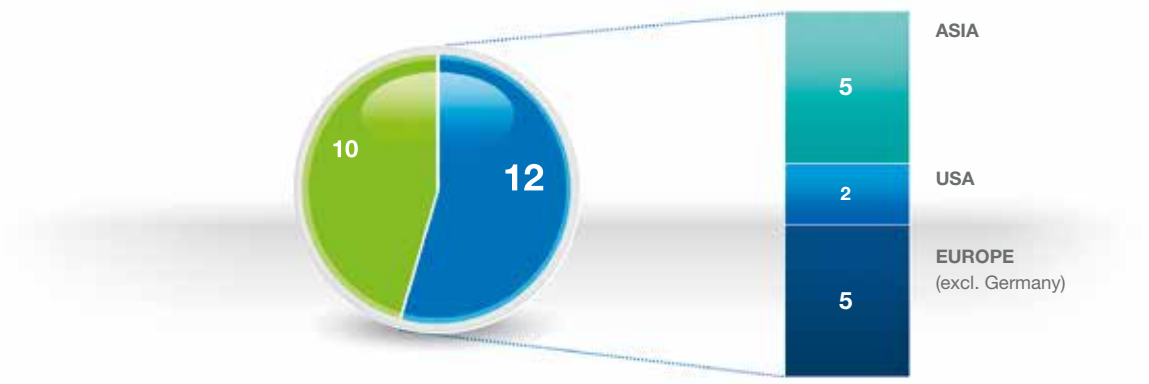
ASAM is internationally gaining in significance

For the past four years ASAM has experienced an increase in members that matches its early days: since 2010, the number of members has increased by more than 40%.



Member Growth

This member growth is – to a great extent – driven by international companies: More than 50% of the new members are from abroad.



2014: New Members by Region

Although the number of new European members is increasing immensely, two regions shall be pointed out in particular: the US and Japan

In the US many OEMs are rejoining after being shaken by the automotive crisis in 2008–2010: GM rejoined in 2011 and Ford Motor Corp. in 2014. The first US standardization work groups has recently released the associated standard "ASAM ODS WebServices" which is published together with the ASAM ODS base standard. Currently, US members are interested in a pre-project that will identify technologies to enable ASAM ODS for Big Data applications.

In Japan, ASAM supported the Japanese ASAM Interest Group (JAIG), an initiative by Japanese OEMs that aimed to study ASAM standards and learn about their application (see use case, p.28). JAIG was founded in 2012 and has now officially ended its two-year term. The feedback from Japanese companies was unanimously positive. Many of the JAIG participants have already joined ASAM, among them Toyota, Honda, Nissan, Hino, Keihin, and several tool suppliers. More companies are expected to follow. Some JAIG members are already executing various comprehensive ASAM projects within their companies.

ASAM continues to encourage exchange among experts both on ASAM related and non-related topics

With the ASAM International Conference in 2013, ASAM hosted, for the first time, an event that did not purely focus on ASAM related topics. Numerous speakers presented current topics within and outside the ASAM scope. The aim was to stimulate discussions that might subsequently trigger new standardization initiatives.

On Dec. 08/09, 2015, ASAM is hosting the 2nd ASAM International Conference. This time **"Big Data in Future Car Development – Chances for Engineering, Value for the Driver"** shall be discussed. Once again, interesting, forward-looking lectures are expected that will be inspiring for your business and for further standardization. For more information see www.asam.net/international-conference.

ASAM continues to collaborate with other standardization organizations

we are in close contact with Eclipse that is hosting the open-source project openMDM since end of 2014; we established direct relations to AUTOSAR and agreed to jointly review new proposals and overlapping changes to our standards; we became an associate member of the ARTEMIS Standardization Working Group that will setup a process to move EU-funded research project results into public standards)

The number of ASAM compliant tools grew

Especially on the ASAM ODS market there a lot of movement could be noticed: Within the past two years, the number of ASAM servers has doubled and the application of the standard is constantly growing.

ASAM is constantly proving that it is a strong partner for standardization. It will continue to support new standardization projects and to promote the usage of ASAM standards in the years to come.

STANDARDS THAT CREATE AN ENGINEERING, SIMULATION, TESTING AND AUTOMATION WORLD WHERE DEVICES AND SOFTWARE APPLICATIONS CAN BE FREELY INTERCONNECTED AND DATA CAN BE SEAMLESSLY EXCHANGED.

BACKGROUND

Automotive manufacturers are being forced to seek out new ways to cut costs while at the same time increasing electronic content to deliver new features to consumers. Standards-based solutions can contribute to both of these goals by making it easier to integrate low-cost off-the-shelf solutions in unique ways to develop cutting edge features for their customers. ASAM standard interfaces, protocols, and data exchange formats help automobile manufacturers survive and thrive in difficult times by enabling engineering teams to deliver the features that customers want while driving down costs.

ABOUT ASAM

ASAM is short for Association for Standardization of Automation and Measuring Systems. The association was founded in 1998 as an initiative of German car manufacturers. ASAM has since established itself as a reliable and strong partner for standardization projects. The ASAM organization was created with the goal of offering a platform for the development of universal standards. End users of a standard (OEMs and system suppliers) bring in their requirements and work together with tool vendors, service providers, and universities to commonly develop and maintain standards. All ASAM members have the opportunity to actively influence the development of the standards. ASAM is a registered association (e.V.) with the head office located near Munich, Germany. The association has currently more than 150 members from the Automotive OEM, Tier-1, and tool supplier communities, as well as universities.

SCOP

Measurement & Calibration

The ASAM standards in the measurement & calibration area support the ECU calibration process. The standards allow to seamlessly connect tools throughout the entire tool chain from the ECU to calibration data management systems. ASAM standards describe calibration protocols for typical automotive bus systems, file formats for unambiguous data exchange and APIs that provide remote access for tools and automation systems. ASAM standards for measurement & calibration are implemented in almost every calibration system on the market.

Diagnostics

ASAM standards in the diagnostics area support the development of diagnostic routines of an ECU and their communication to external devices. They allow a manufacturer-independent description of diagnostic services, error codes, parameters and interfaces available on an ECU. Furthermore, ASAM provides an API for programmatic and vendor-independent access to those features, e.g. from workshop testers.

ECU Networks

The lower-levels of vehicle bus systems are well standardized at ISO, SAE or other standardization organizations. However, they all have their proprietary description format, when it comes to specifying the actual communication on the bus (messages, frames, timing, etc.). ASAM MCD-2 NET (FIBEX) closes this gap by providing a formal data model and file exchange format for this purpose. The standard supports the most popular Automotive bus systems, which are FlexRay, MOST, CAN, TTCAN, LIN and Ethernet.

Software Development

The primary focus of ASAM standards in the software development area is to support the collaboration between customers (OEMs) and its suppliers. ASAM standards cover specific steps in the ECU software development process, for instance, by providing a formal and functional description of software components, software documentation generation, data format for change requests and a blockset for model-based development.

Test Automation

Test systems consist of many components, e.g. tools that control the tests, tools that execute the tests, test scripts, simulation models, sensors, actuators, the units-under-test and much more. They all need to communicate with each other and exchange data. ASAM standards provide APIs for integrating test components from different vendors into a seamlessly working system. If applied consequently, individual components of a test system can be exchanged without the need to re-write test scripts, simulation models, drivers or other major integration efforts.

Data Management & Analysis
ASAM standards for Data Management & Analysis allow to store, search, retrieve and analyze large amounts of data from test stands, data loggers or other sources in the testing area. Clearly defined semantics of the data, APIs for data access, format definitions for database and exchange files makes the data independent from their source and usable on an enterprise level. ASAM standards and compliant tools are an enabler to draw the maximum value from costly test data.

ASAM PROVIDES:

- **For End users:** Easy system integration (plug & play) for automation and measurement systems with ECUs; exchangeability of tools (independent from manufacturer); seamless data exchange; data interpretation without misunderstandings and ultimately a competition boost. Long-term applicability guarantees the safeguarding of investments.
- **For Tool suppliers:** The ability to influence the standards with your knowledge; the ability to minimize development costs due to standardized requirements of various OEMs; the ability to share development costs through a common approach; and an increase in marketing potential.
- **For ASAM service providers:** Know-how about standards; better technical solutions (e.g. connect data loggers with ODS data bases); a door-opener to clients; and a cost advantage due to using a few standards for many customers.
- **For Research institutes:** The opportunity to do industry-oriented research.

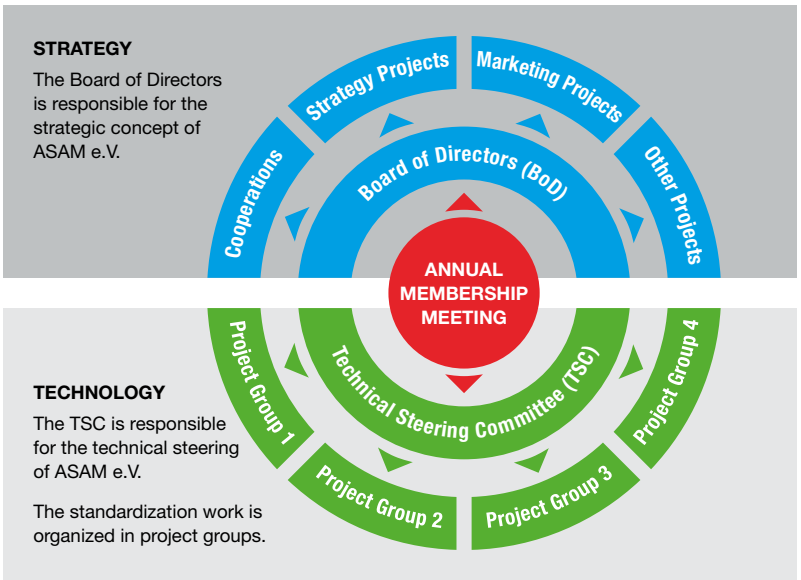
ASAM e.V. – THE ORGANIZATION

ASAM is set up as an incorporated association. This structure allows the integration of new members in the existing organization.
The highest decision-making body of ASAM e.V. is the **Annual Membership Meeting**. Each company has voting rights in proportion to its annual membership fee. The delegates elect the Board of Directors and the Technical Steering Committee for alternating two-year terms. Additionally, they accept the annual financial report, approve changes of the statutes and vote upon any decisions of strategic importance.
The Board of Directors (BoD) has operational control of the association, but is bound to the decisions of the membership meeting. The Board represents ASAM in all legal and public matters, it is responsible for the finances of the association, decides on the admission or expulsion of members, sets guidelines for the other committees and the head office, develops a long-term strategy for the association and monitors its execution.

The Technical Steering Committee (TSC) focuses mainly on technical and market aspects of ASAM standards. The primary goal of the TSC is to ensure that the standard portfolio of ASAM meets market requirements and stays competitive. The committee evaluates technical proposals, monitors the progress of ongoing projects, and reviews and releases new or revised standards.
The actual development work of standards is done by the **ASAM Project Groups**. These groups may work on the development of future versions of a standard (FVD Projects), or carry out maintenance tasks on a standard such as minor revisions or bug fixing (Maintenance Projects). New standard proposals are initiated by the members and submitted to the TSC for approval.
The central coordination role comes from the **ASAM Head Office** near Munich/Germany. It takes care of the distribution of standards, maintains an IT infrastructure for the Project Groups, provides first-level expertise on its standards, carries out technical marketing and provides general membership services.

ASAM cooperates closely with other organizations, e.g. ISO, AUTOSAR, Eclipse, ARTEMIS Standardization Working Group, MOST Cooperation (FIBEX-4MOST) and CAN in automation (CIA). With its representation in Pune, India, ASAM has created more support to advance its standards worldwide.

Organizational Structure



MEASUREMENT & CALIBRATION

Standard *Market Name*	*Type*	*Title*	*Version*	*Content Characterization*	*Technology Reference*
ASAM CDF	BS	Calibration Data Model Format	2.0.0	Format Description (XML)	
ASAM MCD-1 CCP	BS	CAN Calibration Protocol	2.1.0	Protocol Definition	
ASAM MCD-1 XCP	BS	Universal Measurement and Calibration Protocol	1.2.0	Protocol Definition	
	AS	CAN Transport Layer	1.2.0	Transport Layer Specification	
	AS	Ethernet Transport Layer	1.2.0	Transport Layer Specification	
	AS	SxI Transport Layer	1.2.0	Transport Layer Specification	
	AS	USB Transport Layer	1.2.0	Transport Layer Specification	
	AS	FlexRay Transport Layer	1.2.0	Transport Layer Specification	
ASAM MCD-2 MC ASAP2 / A2L	BS	Data Model for ECU Measurement and Calibration	1.7.0	Format Description (NON-XML)	
ASAM MDF	BS	Measurement Data Format	4.1.1	Format Description (Binary)	
	AS	Naming of Channels and Channel Groups	1.0.0	Format Description (Binary)	
	AS	Bus Logging	1.0.1	Format Description (Binary)	
	AS	Measurement Environment	1.0.0	Format Description (Binary)	
	AS	Classification Results	1.0.0	Format Description (Binary)	

DIAGNOSTICS

ASAM MCD-2 D ODX	BS	Data Model for ECU Diagnostics	2.2.0	Format Description (XML)	Communication Parameter Specifications
	AS	Authoring Guidelines	1.0.0	Format Description (XML)	

ECU NETWORKS

ASAM MCD-2 NET FIBEX	BS	Data Model for ECU Network Systems	4.1.1	Format Description (XML)	Communication Parameter Specifications

SOTWARE DEVELOPMENT

ASAM CC	BS	Container Catalog Data Model Format	3.0.0	Format Description (XML)	
ASAM FSX	BS	Functional Specification Exchange Format	1.1.0	Format Description (XML)	
ASAM ISSUE	BS	Issue Exchange Format	3.1.1	Format Description (XML)	
ASAM LXF	BS	Layout Exchange Format	1.0.0	Format Description (XML)	
ASAM MBFS	BS	Model Based Function Specification Standard Blockset	1.0.0		MATLAB, Simulink
ASAM MDX	BS	Meta Data Exchange Format for Software Module Sharing	1.2.0	Format Description (XML)	

BS: Base Standard, AS: Associated Standard, SW: Software

TEST AUTOMATION

Standard *Market Name*	*Type*	*Title*	*Version*	*Content Characterization*	*Technology Reference*
ASAM ACI	BS	Automatic Calibration Interface	1.4.0	API	Corba
ASAM ATX	BS	Automotive Test Exchange Format	1.0.0	Format Description (XML)	
ASAM GDI	BS	Generic Device Interface	4.5.0	Set of Standards	C++ API
	AS	COM Communication Type	3.0.0	Transport Layer Specification	
	AS	IP4 Communication Type	3.0.0	Transport Layer Specification	
	AS	LPT Communication Type	3.0.0	Transport Layer Specification	
	AS	SoftSync Communication Type	3.0.0	Transport Layer Specification	
	AS	USB	3.1.0	Transport Layer Specification	
	AS	Chassis Dyno Device Capability Profile	1.0.0	Application Area Companion	Skeleton
	AS	Crash Device Capability Profile	1.0.0	Application Area Companion	
	AS	MCD-3 Device Capability Profile	2.1.0	Application Area Companion	Skeleton
	AS	MDAQ Device Capability Profile	2.0.0	Application Area Companion	Skeleton MDAQ Profile Definition
ASAM ASAP3	BS	Automation/Optimization Interface for ECU Calibration System	2.1.1	Protocol Definition	
ASAM MCD-3 MC	BS	Application Programming Interface or MC Systems	3.0.0	API	COM/DCOM
ASAM MCD-3 D MVCI D-Server API	BS	Application Programming Interface for D Systems	3.0.0	API	COM/DCOM, JAVA, C++
ASAM XIL	BS	API for ECU Testing via XIL	2.0.1	API	.NET (C#), PYTHON, XIL Software

DATA MANAGEMENT & ANALYSIS

ASAM CEA	BS	Components for Evaluation and Analysis	2.2.0	API	JAVA, .NE
ASAM ODS	BS	Open Data Services	5.3.0	Set of Standards	RPC API, CORBA API
	AS	Open Data Services via Web Services	1.1.1	Application Area Companion	

SOFTWARE

Standard *Market Name*	*Type*	*Title*	*Checked Version(s)*	*Checked Objects*
ASAM MCD-2 MC Checker A2L Checker	SW	ASAM MCD-2 Checker	up to V1.6.1	a2l, aml
ASAM ODS Checker	SW	Data Source Checker	up to V5.1.0	atf, atfx, ODS API

BS: Base Standard, AS: Associated Standard, SW: Software

MEASUREMENT & CALIBRATION

Calibration Data Format

ASAM CDF

An essential part of control algorithms in an automotive ECU are parameters, i.e. scalars, curves and maps. These have a major impact on the control behavior of the ECU and are typically determined through an iterative calibration process. Calibration parameter values are a result of this process. They are produced over time from different tests, for different software versions of an ECU and for different hardware versions of the controlled system. Calibration engineers need the values and further information about their maturity level to be able to decide on further actions. Calibration values are typically processed by multiple tools of the ECU development process, such as calibration data management tools, model-based development tools, code generators, calibration expert systems and product life-cycle management tools. This requires a common file format that is understood by all tools.

ASAM CDF (Calibration Data Format) defines a description format to describe the values of ECU calibration parameters and associated meta data in a well-defined XML format. ASAM CDF is a complementary standard to ASAM MCD-2 MC, in that MCD-2 MC describes the properties of the calibration parameters and CDF describes their values and associated information about their origin and quality.

ASAM CDF supports all data types used in the ASAM MCD-2 MC standard like scalars, curves, maps, arrays and structures. ASAM CDF additionally defines six dedicated maturity levels plus one “undefined” state. These maturity levels can be mapped to company-specific definitions. This allows transferring and correctly interpreting maturity information between different systems.

APPLICATION AREAS

The ASAM CDF standard is widely used in the automotive industry and is supported by every major calibration tool on the market. It is aligned with other ASAM standards like ASAM MCD-1 XCP/CCP, ASAM MCD-2 MC and ASAM MCD-3 MC/ASAP3.

STANDARD AUTHORS

Continental Automotive AG, dSPACE GmbH, ETAS GmbH, Robert Bosch GmbH, Vector Informatik GmbH, XI-Works

Universal Measurement and Calibration Protocol

ASAM MCD-1 XCP

ASAM MCD-1 XCP (Universal Measurement and Calibration Protocol) defines a bus-independent, master-slave communication protocol to connect ECUs with calibration systems. XCP is short for Universal Measurement and Calibration Protocol. The primary purpose of XCP is to adjust internal parameters and acquire the current values of internal variables of an ECU. The first letter X in XCP expresses the fact that the protocol is designed for a variety of bus systems. The standard consists of a base standard, which describes memory-oriented protocol services without direct dependencies on specific bus systems. Several associate standards contain the transport layer definitions for CAN, FlexRay, Ethernet (UDP/IP and TCP/IP) and serial links (SPI and SCI).

ASAM MCD-1 XCP accesses parameters and measurement variables in a memory address oriented way. The properties and memory addresses of this data are described in the A2L-file format, which is standardized through ASAM MCD-2 MC. The A2L-file contains all the information necessary to access and correctly interpret the data that is transmitted via the XCP protocol. This means that access to a specific parameter or variable does not need to be hardcoded into the ECU application. In other words, the ECU contains only a generic XCP-protocol stack, which responds to memory access requests from the calibration system. Different calibration and measurement tasks can be performed by different configurations of the calibration system without recompiling and reprogramming the ECU application code.

ASAM MCD-1 XCP was designed with two main objectives. Firstly, to keep the impact on ECU resources, such as CPU load, RAM consumption and flash

memory, as low as possible, and secondly, to achieve a maximal data transmission rate over the communication link with minimal protocol overhead. The standard also describes the organization of the ECU memory segments used by the ECU software. This allows memory-type specific access. It additionally describes the ECU interface for data read and write access.

APPLICATION AREAS

ASAM MCD-1 XCP is an established and mature standard since 2003 and is used by both OEMs and ECU manufacturers. Compliance to ASAM MCD-1 XCP reduces the variety of calibration systems as well as avoiding the need to create specific ECU implementations for specific application tasks. ASAM MCD-1 XCP originates from the predecessor standard ASAM MCD-1 CCP, which was a measurement and calibration protocol specific to the CAN bus.

STANDARD AUTHORS

Accurate Technologies Inc., Continental Automotive GmbH, CSM GmbH, Daimler AG, dSPACE GmbH, ETAS GmbH, RA Consulting GmbH, Robert Bosch GmbH, Vector Informatik GmbH

ASAM MCD-2 MC

Data Model for ECU Measurement and Calibration

An essential part of ECU software development is the calibration of control strategies parameters. This means the adaption of scalars, curves and maps to achieve an optimized and appropriate system behavior. Internal variables need to be read from the ECU to evaluate the effectiveness of the calibrated software. Such operations are carried out by tools which need a detailed description of the calibration parameters and internal variables. They furthermore need to have a description of the device interface to the ECU for read and write access. This description is typically produced by function developers, software engineers, tool & instrumentation experts, and is used by calibration engineers.

The ASAM MCD-2 MC standard (aka ASAP2) was developed to take into consideration the needs of all groups involved in the calibration process. The standard defines a description format that describes the calibration parameters (called CHARACTERISTIC) and internal variables (called MEASUREMENT) of ECU software. The description includes elementary information like addresses, data types, dimensions, identifiers and much more. To convert the ECU internal characteristic and measurement implementation values into physical values, ASAM MCD-2 MC describes computation methods for their conversion between both representations. Calibration engineers can work with the ECU data in a familiar format without having to understand ECU-internal data formats. Software engineers can provide this data to them or even get the description files automatically generated from code generators. An included mechanism ensures that description files can originate from different sources.

The standard also describes the organization of the ECU memory segments used by the ECU software. This allows memory type specific access. It additionally describes the ECU interface for data read- and write access. Users can create their own descriptions for their specific ECU interfaces via the ASAM Meta Language (AML).
The standard allows the connection of software development tools, calibration tools and ECU calibration interfaces with a neutral description format (A2L). All tools that support the description format are able to exchange and process the included information, hence there are no vendor-specific or technology-specific dependencies between tools of an ASAM-compliant calibration tool-chain.

APPLICATION AREAS

The ASAM MCD-2 MC standard is widely used in the automotive industry and supported by every major calibration tool on the market. ASAM MCD-2 MC V1.7.0 introduced several features needed to calibrate AUTOSAR-compliant ECUs. This includes the introduction of virtual calibration labels, which allow to calibrate highly optimized data structure as they are used in the

MEASUREMENT & CALIBRATION

AUTOSAR basic software modules DEM and DCM. Furthermore, the format now supports the definition of BLOBs (binary large objects) and structured data types. The standard is aligned with other ASAM standards like ASAM MCD-1 XCP/CCP, ASAM CDF and ASAM MCD-3 MC/ASAP3.

STANDARD AUTHORS

AVL List GmbH, Continental Automotive GmbH, dSPACE GmbH, ETAS GmbH, M&K (Mess- & Kommunikationstechnik GmbH, Robert Bosch GmbH, Softing AG, Vector Informatik GmbH, Visu-IT! GmbH

Measurement Data Format

ASAM MDF

Many software applications still use proprietary file formats to store acquired or calculated data. As a consequence, an exchange of data between different tools usually requires time-consuming data conversions that involve potential loss or alteration of information. The development of such converters is expensive and error-prone. Hence, a commonly accepted standard format greatly improves the seamless exchange of data between tools.

MDF (Measurement Data Format) is a binary file format which stores recorded or calculated data for post-measurement processing, off-line evaluation or long-term storage. MDF was originally developed as a proprietary file format in the 90s for use in the automotive industry, primarily for the areas of ECU development, calibration and testing. Since then, the format has evolved into a de-facto industry standard and is supported by many tools on the market, particularly by all leading tools in the measurement & calibration area. In 2009, MDF has been transferred to ASAM as an official industry standard.

As a compact binary format, ASAM MDF offers efficient and high performance storage of huge amounts of measurement data. MDF is organized in loosely coupled binary blocks for flexible and high performance writing and reading. Fast index-based access to each sample can be achieved by loss-free re-organization (i.e. sorting) of the data. Distributed data blocks even make it possible to directly write sorted MDF files. The file format allows storage of raw measurement values and corresponding conversion formulas, therefore raw data can still be correctly interpreted and processed by post-processing tools.

Since it became an ASAM standard, MDF has been developed in close alignment with other ASAM standards such as MCD-2 MC (ASAP2) or ODS. Consequently, ASAM MDF supports special data types and information particularly required in the automotive area, e.g. structures and arrays (curves/maps), bus events and synchronized video data.

In addition to the plain measurement data and all necessary meta information for its interpretation, MDF can also store descriptive and customizable supplementary data within the same file. MDF 4.0 offers flexible extensibility via generic XML fragments and a range of new features like custom signal grouping, events or attachments.

LATEST ADDITIONS AND IMPROVEMENTS

The latest releases of MDF, version 4.1.0 and 4.1.1, introduced:

- compression of measurement data
- memory-efficient storage for channels with constant value or variable data length
- storage of bus traffic for common bus systems
- storage of classification results
- storage of additional information about the measurement environment
- transformation of a not-finalized file to a finalized file

STANDARD AUTHORS

AUDI AG, AVL List GmbH, BMW AG, dSPACE GmbH, ETAS GmbH, Porsche AG, Vector Informatik GmbH

DIAGNOSTICS

ASAM MCD-2 D

Data Model for ECU Diagnostics

The electronics of passenger and commercial vehicles can be diagnosed, configured and programmed with new software. The design of these functions is specific to a vehicle model and/or manufacturer and thus the diagnostic capabilities of every vehicle and built-in ECU are highly individual. Within the life-cycle of the vehicle (engineering, production, service, end-of-life) many tools and applications access the ECU for testing, activation, de-activation, configuration and updating purposes. Before the standardization of ODX (Open Diagnostic Data Exchange) the diagnostic and configuration capabilities as well as the flash data descriptors were specified in non-standardized, mostly non-machine readable data formats (e.g. Word, PDF). Consequently, the relevant data had to be manually entered into all tools of the life-cycle, which is error-prone, expensive and impedes fast development cycles.

ODX addresses these challenges by providing an XML-based, machine-readable data format to specify and exchange vehicle and ECU diagnostic capabilities including variants throughout the vehicle life-cycle. ASAM took great care in producing a semantically well-defined data model that is the foundation for the data format. Together with the related standards ASAM MCD-3 D and ISO 22900-2 (D-PDU API), an architecture for vehicle communication has been defined that permits seamless processing of diagnostic, configuration and flash reprogramming data. This architecture enables the complete reuse of diagnostic data throughout the ECU's life-cycle and thus prevents errors and reduces effort for the creation of test-, configuration- and reprogramming-sequences.

Furthermore, ODX is independent of particular vehicle diagnostic protocols such as the KW 2000 (ISO 14230), UDS (ISO 14229) or SAE J1939. ODX is designed as a data model to describe the structure of data streams (aka "diagnostic services") and arbitrary protocols. In addition, specific descript ion formats have been defined to describe configuration data structures, flash re-programming data and vehicle functions.

ODX allows for some variance of how the vehicle and ECU capabilities are expressed. As a uniform usage of ODX within the process leverages greater benefits in using the data, it is an established best practice to formulate authoring guidelines for the creation of ODX and implement these guidelines in editors and/or checking tools.

APPLICATION AREAS

The standard ODX can be employed anywhere in the vehicle life-cycle where vehicle electronics are tested, configured of flash re-programmed. OEMs employing this standard have reported considerably reduced setup times in the production of new models, highly reduced vehicle communication problems with diagnostic scan tools and much better support for vehicle variants.

STANDARD AUTHORS

Audi AG, BMW AG, Continental Automotive GmbH, Daimler AG, DSA Daten- und Systemtechnik GmbH, ETAS GmbH, General Motors Company, In2Soft, Porsche AG, Renault S. A., Robert Bosch GmbH, Siemens AG, Softing Automotive Electronics GmbH, SPX UK Ltd, Vector Informatik GmbH, Volkswagen AG

ECU NETWORKS

Data Model for ECU Network Systems

ASAM MCD-2 NET

During the implementation of ECU software, the correct configuration of the operating system's network stack is a fundamental requirement in ensuring the interoperability of ECUs within automotive networks. The configuration includes the definition of exchanged signals, datatypes and their explicitly defined declarations for various automotive communication systems. This information is typically provided in interface descriptions created by OEMs and forwarded to their ECU suppliers.

The ASAM MCD-2 NET standard (called FIBEX) provides a uniform, XML-based interface description for configuring the software of automotive networks. The standard allows the definition of network topologies, consisting of ECUs with network ports and gateways. The standard consists of a generic interface description and technology-specific extensions for FlexRay, MOST, CAN, TTCAN, LIN and Ethernet. Technology-specific properties are described for each network port. For example, addresses as well as transport protocols and the reserved ports are described for Ethernet and IP. Furthermore, the interface description contains a list of sent and received signals for each ECU. In the case of service-oriented communication, service provider instances and consumers are listed for each ECU.

ASAM MCD-2 NET is used for the design, configuration, monitoring and simulation of communication on automotive networks. For example, the standard supports auto-generation of software code for ECUs and the configuration of test tools for simple testing of ECUs. Test tools, which can import the interface description, are able to interpret network traces or carry out residual network simulation.

APPLICATION AREAS

The ASAM MCD-2 NET standard is widely used in the automotive industry and is harmonized with the AUTOSAR system template. The current version 4.1.1 made the standard compatible with AUTOSAR 4.1 and resolved a few bugs.

STANDARD AUTHORS

Audi AG, BMW AG, Daimler AG, dSPACE GmbH, Elektrobit Automotive GmbH, ETAS GmbH, IXXAT Automation GmbH, National Instruments Corporation, Robert Bosch GmbH, Softing Automotive Electronics GmbH, Sulzer GmbH, Vector Informatik GmbH

SOTWARE DEVELOPMENT

Container Catalog

ASAM CC

ASAM CC (Container Catalog) is used for describing engineering objects such as source code, compiled objects or documentation files. The objects are described with meta information such as creator, name, description, version, engineering domain, configuration and storage location. The standard is primarily used for exchanging information about engineering objects between OEMs and suppliers. Since ASAM CC-compliant description files are based upon XML with a standardized schema, tools and data repositories can import and export the data easily. Incremental data exchange is supported.

ASAM CC has the following main features:

- Description of the repository structure
- Description of the meta data for engineering objects
- Extensibility of the data model
- Revision information and change histories
- Support for linking
- Support for conditional document configurations (conditional compilation)
- Support for content view filtering

STANDARD AUTHORS

Continental Automotive AG, MAN Truck & Bus AG, Robert Bosch GmbH, XI-Works

ASAM FSX

Functional Specification Exchange Format

A lot of companyes use common word processors or their own documentation systems to create functional specifications for software components. These systems are typically based on proprietary formats e.g. Word, PDF or HTML. This becomes a problem when different parties undertake projects. OEMs which develop parts of the ECU software and want to exchange their software components with one or more suppliers have to provide different documentation formats. Suppliers that have to integrate software components from different parties have to process different types of functional documentation formats and merge them with their own documentation to create a complete documentation of the ECU software.

Consequently, integrated documents often appear to be fragmented and inconsistent. Styling, layout and content structure may vary greatly across a document. Different documents aren't linked to each other by cross references and don't have shared tables of contents or indexes. This makes the readability and traceability of the documentation worse. Documentation, which is patched together in such a way, can give a confusing and unprofessional impression to readers.

The exchanged documents, furthermore, do not allow for parsing and extraction of data like labels, revision numbers and status of the software. The exchanged data formats are mostly pure presentation formats, which do not support a defined document content structure. Authors are allowed to do everything everywhere. This reduces the possibilities of automated data post-processing.

The functional documentation of software has to meet additional requirement like variant handling (i.e. create documents for each variant of a software component), handling of multilingual documents (i.e. create documents for different languages) and filtering of content (e.g. documents for internal and external use).

Different formats, the lack of machine-readability and no support for creating different versions of the documentation causes an increased workload for OEMs and suppliers. ASAM FSX (Functional Specification Exchange) overcomes those problems by defining an XML-based, machine-readable format for the creation, processing and exchange of functional documentation of software for ECUs. ASAM FSX has the following main features:

- Description of software functions
- Standardized documentation structure
- Possibility to extend the documentation structure
- Full featured XML text model
- Support for multilingual texts
- Linking and indexing support
- Revision information and change histories
- Support for conditional document configurations (conditional compilations)
- Support for content view filtering

The standard is primarily used in the areas of model-based software development and software functional documentation. ASAM FSX is complementary to ASAM MDX, which contains the interface definitions of software functions.

STANDARD AUTHORS

Audi AG, Continental Automotive AG, Daimler AG, MAN Truck & Bus AG, Robert Bosch GmbH, Visu-IT! GmbH, Volkswagen AG, XI-Works

SOTWARE DEVELOPMENT

Issue Exchange Format

ASAM ISSUE

The development of software for electronic control systems is becoming increasingly widespread, either within one company or spread over several companies. Iterative and highly dynamic software development cycles between car makers and their suppliers cause an increasing amount of change requests, problem reports, and require a decreasing amount of time for solutions to be found. All parties involved have to concentrate on the actual issue content and not waste time on administrative tasks. Without automation the percentage of administrative work can easily amount to 50% of the total work needed to resolve an issue. This situation represents an increasing challenge for the automotive industry.

There is, furthermore, a clear motivation to go for a standardized cross-industry solution. Bilateral approaches between OEMs and system suppliers decrease productivity, as system suppliers would typically have to maintain several OEM-specific solutions in parallel. Previous to the ASAM-based solution, Email, fax and shared drives were the main channels for issue related information exchange. This had many disadvantages, as typically data consistency and progress tracking could not be ensured along the lifecycle of an issue request.

The ASAM ISSUE standard was created to overcome the problems of different exchange systems, information inconsistency and lack of progress tracking. The ISSUE schema is able to transport relevant information for an issue (e.g. identifier, title, responsible, lifecycle status, short textual description, delivery information, issue context, attachments) and is able to act as a tool-independent format for the exchange of change requests and problem reports between companies and their tools.

The schema of the ASAM ISSUE standard is flexible enough for process adaptations, but is still strict enough to allow content checks. In order to benefit from the ISSUE standard, it is necessary to export / import issues to the company-defined configuration & change management system. Some systems on the market provide such an ISSUE interface. The status of an issue remains fully transparent for all involved parties, as the complete lifecycle of an issue is supported and status changes are propagated.

STANDARD AUTHORS

Audi AG, BMW AG, Continental Automotive GmbH, MAN Truck & Bus AG, Porsche AG, Robert Bosch GmbH

Layout Exchange Format

ASAM LXF

The results of data post-processing are typically compiled in an automatically generated report. Tools that generate such reports use a description file that defines the layout of the reports. ASAM LXF standardizes the layout format description so that it can be defined once for a specific report and then shared among different reporting systems. This reduces the effort to maintain layout descriptions to a minimum and ensures that reports of the same type look the same, even though they have been created by different tools.

ASAM LXF (Layout Exchange Format) defines an XML-based format for describing layouts for graphical content used by data post-processing applications and automated document generators. A layout description contains the definition of a master layout, canvases, page formats, fonts and colors. The master layout determines the general page design, e.g. by specifying a header and footer, which are used on all pages. A page may contain just one canvas or a matrix of canvases. A canvas defines a drawing area and contains a set of graphical elements, such as images, lines, ellipses, rectangles, charts, tables or text. Elements can be grouped in one container. The XML format may contain embedded formulas that are resolved during runtime.

APPLICATION AREAS

ASAM LXF is harmonized with and typically used in conjunction with ASAM CEA, which produces the content for generated reports.

STANDARD AUTHORS

AMS GmbH, Horiba GmbH, National Instruments Corporation, Porsche AG, Volkswagen AG

ASAM MBFS

Model Based Function Specification

Embedded software development increasingly relies on model-based development and graphical programming. This has the advantage that control algorithms are more understandable to engineers, are better documented and that the specification is written in an executable format. Models are frequently the input for production code generators.

The core of model-based development is the blockset, which essentially represents the programming language of the model. Several vendor-specific tool-suites emerged on the market, that use different blocksets with different semantics and different graphical representations. Although the blocksets are similar among all vendors, their differences still make conversion of models between different tool-suites very labor intensive and error-prone. Embedded software developers have to therefore learn different blocksets, which is an additional effort.

ASAM MBFS (Model Based Function Specification) over comes this problem by setting a standard for a blockset library. The blockset consists of 70 blocks, which cover the typical functionality needed in embedded software development. The standard includes blocks for linear and non-linear math operators, logical and relational operators, counters and timers, integrators, filters, curves, maps, delays, switches and memory blocks. ASAM MBFS defines for each block:

- the graphical representation (icon, ports)
- input, output, internal states and temporary variables
- the semantics (verbal description and pseudo code)
- test vectors

APPLICATION AREAS

Blocksets that are implemented according to ASAM MBFS are available in major tool-suites for model-based development and graphical programming. They are supported by code generators for production code generation. ASAM MBFS includes a description of a reference implementation in MATLAB/Simulink.

STANDARD AUTHORS

Audi AG, Robert Bosch GmbH, Continental Automotive GmbH, Daimler AG, dSPACE GmbH

ASAM MDX

Meta Darte Exchange Format for Software Module Sharing

The development of software for automotive ECUs is typically carried out in distributed development processes, where software originating from different suppliers and engineering groups have to be integrated into one executable. Software integration is a highly repetitive and iterative task. If the suppliers used different interfaces or software architectures for the same software system, then the initial software integration will fail and cause time consuming debugging and issue-resolution activities. Failed software integrations are one of the major causes of ECU projects running out of time and budget.

To solve this problem, automotive companies have defined a description format via the ASAM MDX standard, which describes software functions, their interfaces, owned data and scheduling in a standardized XML-format. ASAM MDX contains the following definitions for functions and data:

- Software components, -features, -classes and -services
- Variables, calibration parameters and system constants
- Base types
- Type definitions for structures, enumerations and unions
- Units, constraints, computation methods, address methods and much more data properties

This format allows the user to unequivocally specify all integration aspects of the embedded software functions. OEMs have the advantage that they can link supplied software with the overall system without permanently running into integration issues. Suppliers can hide their know-how by delivering just the object code. The object code can still be linked and calibrated, even though the sources of the supplied software are not known by the integrator. Since MDX

SOTWARE DEVELOPMENT

is technology- and vendor-independent, it allows all involved parties in a software development process to use the tools of their choice, as long as they are able to import and export MDX-compliant description files. ASAM MDX can describe all data constructions (measurements and characteristics) defined in ASAM MCD-2 MC and the AUTOSAR Software Component Template. Furthermore, ASAM MDX is complementary to ASAM FSX, which contains the behavioral description of software functions.

STANDARD AUTHORS

Audi AG, Continental Automotive AG, MAN Truck & Bus AG, Robert Bosch GmbH, Visu-IT! GmbH, Volkswagen AG, XI-Works

TEST AUTOMATION

Automatic Calibration Interface

ASAM ACI

The majority of ECUs in a vehicle undergo the calibration development step. The calibration of some vehicle components can be very complex and time consuming. This is particularly true for internal combustion engines. The role of an engine ECU is to continuously measure a large amount of engine data (requested load, speed, fuel and air temperature, etc.) and to calculate a set of optimal control output signals. The control strategies of the engine ECU have to meet contradicting optimization goals (high torque at low fuel consumption and emission, etc.) in a multitude of different environment and dynamic load conditions. Running the tests on an engine dynamometer to find the optimal calibration parameters, curves and maps is a function of many input parameters and conditions. This complex task can hardly be done manually anymore within acceptable time and cost limits. Consequently, test stands are increasingly equipped with systems that automate the calibration task.

ASAM ACI (Automatic Calibration Interface) defines an interface between test stand automation systems (TAS) and automated calibration systems (ACS). The interface consists of an object-oriented, client-server API, which offers four services. The services are requested by the ACS (the client) and carried out by the TAS (the server):

- **Player service:** controlling of test stand actuators for set-point adjustment
- **Recorder service:** recording of measurement values (mean or actual) from the test stand
- **Watcher service:** monitoring of out-of-bounds channel values
- **Device service:** further services such as ECU-specific and test stand-specific operations

The services allow the ACS to preset the unit-under-test, request specific measurement tasks and retrieve the measurement values from the TAS. Based on these services, an ACS can automatically run a set of predefined tests, modify tests based upon earlier test results and even modify ECU calibration parameters of the unit-under-test. Client and server may reside on different host systems and communicate via TCP/IP. ASAM ACI is suitable for both static and transient test executions. The interface is currently not suitable for supporting an ACS that has to respond under real-time conditions.

APPLICATION AREAS

ASAM ACI was initially developed with engine calibration in mind. However, the standard has been successfully used in other test environments such as wind tunnels, electrical motor test stands and in-vehicle test systems.

STANDARD AUTHORS

A&D Company, AVL LIST GmbH, BMW AG, Daimler AG, D2T, ETAS GmbH, FEV Automatisierungssysteme GmbH, Horiba GmbH, Kristl, Seibt & Co GmbH, M&K Mess- u. Kommunikationstechnik GmbH, Renault S.A., Volkswagen AG

ASAM ATX

Automotive Test Exchange

Increasing complexity in the field of automotive electronics together with extended quality requirements causes additional investments for test automation. A lot of ECU projects use customized and vendor-specific turn-key test systems. For instance, such test systems typically use test automation software that is rigidly coupled with specific measurement & calibration hardware. The test automation software additionally stores test cases in proprietary formats. As a consequence of this, the choice of test software and test hardware, which can work together seamlessly, is very limited and often dictated by the turn-key system vendor.

If a user of testing systems is determined to use best-in-class systems that do not originate from one vendor, he will be confronted with an increased workload to maintain the different systems with regards to know-how, support, version compatibility and other issues. This is particularly true when different software systems are used for test case development. This can lead to the following problems:

- Know-how cannot be easily transferred from one test bench to the other (additional training costs for employees)
- Switch to the newest testing technology will always be difficult because of tool-specific formats and test-hardware incompatibility
- Test cases cannot be easily ported from one test system to another

ASAM ATX (Automotive Test Exchange) overcomes those issues by providing a standardized XML format, which enables the exchange of test data between different test systems. ATX supports the ISTQB "Certified Tester" syllabus methodology and can be used for many activities in the test process, e.g. test specification, test planning, test execution and test evaluation. The following data is handled by ASAM ATX:

- Test projects
- Test specifications
- Meta data of test cases, test steps and test actions, e.g. version information, documentation and implementation information
- Test programs
- Test libraries
- Test data (parameter values)
- Test suites (execution plans)
- Test reports and test result data

APPLICATION AREA

ASAM ATX is frequently used in conjunction with ASAM HIL in hardware-in-the-loop test systems.

STANDARD AUTHORS

ALL4TEC, Audi AG, Berner & Mattner Systemtechnik GmbH, BMWAG, Robert Bosch GmbH, dSPACE GmbH, Daimler AG, ETAS GmbH, MAN Truck & Bus AG, MBtech Group GmbH & Co. KGaA, M&K Mess- und Kommunikationstechnik GmbH, TraceTronic GmbH, Vector Informatik GmbH, XI-Works

TEST AUTOMATION

Generic Device Interface

ASAM GDI

ASAM GDI (Generic Device Interface) was developed for providing an independent integration interface between measurement & control devices and test bed automation systems. Previously, this area was characterized by an almost unmanageable number of individual and incompatible devices. Integration of devices depended strongly on the availability of device drivers for specific operating systems, physical interfaces and protocols. Since test beds have a long lifetime, devices of different generations had to coexist in one system. All this caused high integration efforts, whenever a device had to be integrated or exchanged in an existing test bed system.

The goal of the standardization was to reduce cost and time efforts for the creation, support and maintenance of such complex automation systems and their measurement and control devices. Ideally, a new device would be integrated in a plug-and-play fashion with minimal to no integration efforts. Therefore, the GDI standard defines a four-layer architecture:

- **LAYER 4 - Coordinator:** The coordinator connects application programs to devices, i.e. by routing required application functionalities to device functionalities. The coordinator is configured via a parameterization instance description file (PID), which contains all abstract data sinks and sources and their connection to devices.
- **LAYER 3 - Device Driver:** The device driver provides uniform, virtualized access to the device via a model of the devices functionality and internal states. The device driver is described by the device capability description file (DCD).
- **LAYER 2 - Platform Adapter:** Provides standardized interfaces to specific devices and OS functions.
- **LAYER 1 - Transport Layer:** Provides the transport layer and communication types for communicating with devices via IPv4, USB, SoftSync, COM or LPT.

This approach abstracts the test bed automation system from the operating system, communication busses, protocols and measurement & control devices. As a result, ASAM GDI allows a device-independent application execution and application-independent device integration. This allows quickly exchanging devices in existing test beds, or conversely migrating to a new test automation system with less effort while still using existing measurement & control devices.

APPLICATION AREAS

ASAM GDI is used in chassis dynamometers, engine dynamometers, emission test benches and transmission test beds. Furthermore, GDI-compliant devices are used in car assembly lines, e.g. for fluid-filling stations, and in service areas where miscellaneous measurement modules are integrated into a shop floor tester. The standard is also used for the integration of data loggers and measurement modules for supplier-independent device configuration.

LATEST ADDITIONS AND IMPROVEMENTS

The most recent version, ASAM GDI 4.5.0 was released in 2011. This version includes the parameterization instance description (PID) file format in XML, which provides a mapping of required application functionalities onto device functionalities. The PID file allows exchanging a device in a testing system without needing to make any modifications to the test bed automation software. Furthermore, the latest ASAM GDI version was harmonized with the corresponding ISO Standard 20242.

STANDARD AUTHORS

AVL List GmbH, BMW AG, Daimler AG, dSPACE GmbH, FEV Automatisierungssysteme GmbH, General Motors Company, imc Meßsysteme GmbH, Elektrobit Automotive GmbH, HORIBA Automotive Test Systems GmbH, MFP GmbH, M&K GmbH, National Instruments Corporation, Porsche AG, rd electronic GmbH, Renault S.A., Siemens AG, Volkswagen AG

ASAM MCD-3 MC

Application Programming Interface for MC Systems

One of the major tasks of ECU development is the calibration of control strategies, i.e. tuning of parameters and look-up tables and the recording of values of internal variables during the runtime of the ECU. This is done via various busses, bus protocols or proprietary plug-on devices between the ECU and an application system. These are technology-dependent and can be vendor-specific. MC-servers are used to provide uniform calibration access to ECUs independent of the used busses, protocols or interfaces. The main objective of ASAM MCD-3 MC is to provide a remote control interface for such MC-servers, primarily by providing measurement and calibration services via an OO-API to the upstream tool-chain. The main advantage of the API is the encapsulation of vendor-specific and technology-dependent communication interfaces. The standard allows that any client application, such as test automation systems or automated calibration systems, can connect via the MC-server to an ECU and carry out typical measurement and calibration tasks. Several ECUs can be connected to one MC-server and accessed in parallel through client applications.

To be able to access data on an ECU, the MC-server reads an A2L data description file (ASAM MCD-2 MC), which contains a description of available calibration parameters (CHARACTERISTICS) and measurement variables (MEASUREMENTS). The MC-server then makes services available to access this data. Characteristics of the type ‘scalar’, ‘curve’, ‘map’, ‘cube 3D’, ‘cube 4D’, ‘cube 5D’, ‘value block’ and ‘ASCII’ can be adjusted. Measurement tasks are available via the Collector, Watcher and Recorder services. The Collector acquires the values of MEASUREMENT or CHARACTERISTIC objects with a common rate over a defined period of time (continuous data acquisition). The Recorder is a means to managing high bandwidth measurements that the MC-server acquires from the ECU or other external inputs, but which cannot be transferred from the MC-server to client applications synchronously because of the lower available bandwidth. Measurement data is therefore stored in a file that can be retrieved by client applications later on. A Watcher is a service which continuously monitors measurement values and triggers events if a predefined condition evaluates to “true”. Multiple Watchers can be defined to monitor multiple variables at the same time. The Watcher may be used to start and stop Collectors or Recorders.

The standard is used for calibration and measurement purposes in development, testing and production of ECUs. ASAM MCD-3 MC currently coexists with the older ASAM ASAP3 standard, which is dependent on specific interfaces (RS232, TCP/IP) and still holds a significant market share.

The ASAM MCD-3 MC API is specified in an object-oriented but technology-independent UML model and mapped to DCOM. This allows to easily add new programming language mappings to the standard without having to change the core of the standard.

LATEST ADDITIONS AND IMPROVEMENTS

The latest release of ASAM MCD-3 MC is version 3.0.0. It improves the loading-time of MC-servers and the connection and release of client applications.

STANDARD AUTHORS

AFT GmbH, AVL List GmbH, Robert Bosch GmbH, BMW AG, D2T, Daimler AG, dSPACE GmbH, ETAS GmbH, IMC Meßsysteme GmbH, M&K Mess- und Kommunikationstechnik GmbH, Porsche AG, HORIBA GmbH, Continental Automotive GmbH, Visu-IT! GmbH, Vector Informatik GmbH

TEST AUTOMATION

Application Programming Interface for D Systems

ASAM MCD-3 D

The ECUs of passenger and commercial vehicles can be diagnosed, configured and programmed with new software. These use-cases are performed through serial bus communication on established vehicle busses like CAN, K-Line or even Ethernet. Many different diagnostic protocols are used for the communication between an external test device and the ECU, e.g. UDS, KW2000 or J1939. Common to all these protocols is that the data stream is hexadecimal encoded and cannot be interpreted without detailed documentation of the data content. Before the standardization of ASAM MCD-3 D, it was common practice to implement diagnostic, flash reprogramming and configuration applications on the basis of these hexadecimal encoded messages. The increasing complexity of ECUs, their high number of variants and shortened development cycles made it virtually impossible to continue implementing diagnostic applications in this manner.

The standard ASAM MCD-3 D is employed anywhere in the vehicle life-cycle where vehicle electronics are tested, configured or re-programmed. The standard describes the API of a diagnostic kernel that is able to interpret the hexadecimal encoded messages and provides them as human-readable data values to an application. In order to achieve this, a compliant diagnostic kernel interprets an ODX data description file (ASAM MCD-2 D), which contains a full description of diagnostics data and their conversion between the physical and encoded views. The diagnostic kernel is also capable of resolving ECU variants and thus allowing the implementation of applications valid for multiple variants. Employing a diagnostic kernel is a key aspect of establishing an ODX-based diagnostic process chain as such a kernel guarantees uniform interpretation of the ODX data.

It was an important design goal of the ASAM MCD-3 D standard to cover all known vehicle communication use-cases based on diagnostic protocols and to establish a solution that is independent of the used protocol. An application developer needs to have no further knowledge of particular diagnostic protocols when implementing against the API. The ASAM MCD-3 D API is specified in an object-oriented but technology-independent UML model and then mapped to popular software technologies such as Java, C++ or DCOM. This allows to easily add new programming language mappings to the standard without having to change the core of the standard.

LATEST ADDITIONS AND IMPROVEMENTS

The latest release of ASAM MCD-3 D is version 3.0.0. Its main additions were the support for ASAM MCD-2 D / ODX V 2.2.0 and the integration of DoIP (Diagnostics over Internet Protocol) capabilities.

STANDARD AUTHORS

Berner & Mattner Systemtechnik GmbH, BMW AG, Daimler AG, DSA Daten- und Systemtechnik GmbH, ETAS GmbH, General Motors Company, In2Soft, M&K Mess- und Kommunikationstechnik GmbH, Porsche AG, Samtec GmbH, Siemens AG, Softing Automotive Electronics GmbH, SPX UK Ltd., Vector Informatik GmbH, Volkswagen AG

ASAM XIL

Generic Simulator Interface

ASAM XIL is an API standard for the communication between test automation tools and test benches. The standard supports test benches at all stages of the development and testing process – most prominently model-in-the-loop (MIL), software-in-the-loop (SIL) and hardware-in-the-loop (HIL). The notation "XIL" indicates that the standard can be used for all "in-the-loop" systems. This has the advantage that it enables users to freely choose testing products according to their requirements and integrate them with little effort.

The standard furthermore decouples test-cases from real and virtual test systems. This allows to transfer tests between different test systems with little to no migration effort. Consequently, tests can be easily re-used. Know-how is much easier transferred from one test bench to another, resulting in reduced training costs for development- and test engineers.

The ASAM XIL API comprises access to the following components of the simulation system:

- Reading/writing parameters in simulation models
- Capturing/generating signals in simulation models
- Capturing, reading and writing of ECU variables
- Capturing of network messages (CAN only with current version)
- Exchanging data with an ECU via diagnostic services
- Controlling electrical error simulation hardware (e.g. to set up short circuits)

APPLICATION AREAS

The ASAM XIL API is primarily used by hardware-in-the-look simulators (HIL systems) for testing ECU in real-time. The standard has been successfully applied in powertrain, steering and electric lighting tests.

QUALITY ASSURANCE

Cross tests for ASAM HIL installations have been carried out in 2012 and are planned for the future to ensure compatibility between test automation software and HIL test systems.

STANDARD AUTHORS

AUDI AG, AVL List GmbH, Berner & Mattner Systemtechnik GmbH, BMW AG, Robert Bosch GmbH, Continental Automotive GmbH , D2T, Daimler AG, dSPACE GmbH, ETAS GmbH, HORIBA Automotive Test Systems GmbH, M&K Mess- und Kommunikationstechnik GmbH, MBtech Group GmbH & Co. KGaA, National Instrument Corporation, RA-Consulting GmbH, Softing Automotive Electronics GmbH, TraceTronic GmbH, Vector Informatik GmbH

DATA MANAGEMENT & ANALYSIS

Component for Evaluation and Analysis

ASAM CEA

Plenty of test-data post-processing applications are available on the market, which have either a proprietary plug-in architecture or no plug-in capabilities at all. Customized solutions for such applications, such as data file importers, special mathematic algorithms or special graphic elements, cannot be easily reused in another application and would require significant porting effort.

ASAM CEA (Component for Evaluation and Analysis) defines an application framework and functional components for the evaluation and analysis of test measurement data. The standard is most commonly used for the development of reusable application components for processing and visualization of testing data. It defines everything to create components in a standardized way in order to be able to be used in different programs from different manufacturers. If the application framework is compliant with the CEA-standard, then CEA-components can be loaded and used by the application. If the framework follows modern SW-architectural rules (e.g. object oriented, event driven, full-state, etc), then it will be easy to implement the functions needed for CEA-compliance.

The standard describes the necessary techniques for component developers. ASAM CEA defines a component-based framework within a producer-consumer architecture. For a well-defined runtime sequence structure, events are defined which inform “consumers” of any change within the content. The framework can be extended by plug-in components. The interfaces, data items and events are clearly defined to obtain interchangeable components between CEA-compliant frameworks.

The standard itself is described as completely technology independent. It is tested and examples are available for C/C# and Java. In addition, a sample framework together with sample components are available as part of the standard to allow interested companies to start developing their own CEA-based applications.

APPLICATION AREAS

ASAM CEA-compliant software is used in many industry applications. Many of them are running as web-based solutions inside a Measurement Data Management (MDM) system:

- **Engine / turbocharger test bench:** Online visualization, user interface and test-data post-processing.
- **Battery test stand:** Post-processing of test stand data.
- **Gear test stand:** Post-processing of terabytes of data incl. customized statistics components in a client-server application.
- **Data logger:** Vehicle test data analysis with logged data incl. GPS, movies and time signals.
- **Crash-data post-processing:** Importing of raw test data, creating MME13499-compatible data structures and generation of standardized reports.
- **Calibration lab for sensors:** Creating multi-page calibration reports.

STANDARD AUTHORS

AMS GmbH, Daimler AG, Horiba GmbH, Porsche AG, Volkswagen AG

Open Data Services

ASAM ODS

Numerous solutions in testing, evaluation and simulation within the automotive industry have their own administrative systems and proprietary formats to store data, with very different approaches in maintaining descriptive information. Extending and modifying such solutions, and connecting them to third party components, is a growing challenge as complexity is continuously increasing. Also the demand for unified knowledge bases as a foundation for data mining and for cross-disciplinary collaboration cannot be met by such diverse and usually inaccessible information pools. New ideas from new players in the market will hardly find their way into legacy systems unless an easy and standardized way for information access is available. Finally, the need for product lifetime storage & retrieval calls for standardized methodologies that may be used even if tools and businesses have been discontinued.

The ASAM ODS (Open Data Services) standard focuses on persistent information storage & retrieval. The main objectives are to reduce costs and risks within projects and to provide a reliable basis for applications that produce and/or consume information. Using standardized interfaces and common data structures minimizes the efforts for system integration within heterogeneous environments and significantly eases information exchange. It moreover allows the integration of light-weight solutions that work on a standardized information pool. A fully standardized persistence layer secures the investments made in such data server systems, as information becomes independent from specific implementations.

ASAM ODS specifies:

- A common data model (base model) for unambiguous and complete definition of data, providing a rough classification by adding semantics to the data, which finally enables different systems to interpret similar data in the same way. It serves as a basis for many derived application models, which themselves cover the needs of specific application areas.
- Interfaces to store & retrieve data in ODS servers in a standardized way, including interfaces to maintain a formal description (meta-information) of the actual application model. This allows systems to generically operate on different ODS data sources.
- Standardized text-based formats (ASAM Transport Format) for exchanging data and meta-information between different systems & platforms (two variants: ATF/CLA, ATF/XML).
- A database model for relational databases used to physically store the information. It also allows exchanging database files between systems with the same data base management system.
- Application models, reflecting typical scenarios for the use of ASAM ODS. Currently models for NVH data, test bed calibration data, workflow descriptions and results, crash test data, geometrical data, and data from bus communications are provided.

APPLICATION AREAS

ASAM ODS is predominantly used in the area of test automation and test bed systems, but is not limited to this area and can be used wherever information must be stored in a consistent manner. Application areas are: Test Data Management, Measurement & Calibration, Integration of Automation and Measurement Systems, Simulation, Data Post-Processing, Reporting, etc.

LATEST ADDITIONS AND IMPROVEMENTS

Version V5.3.0 shows following major improvements:

- UTF-8 support is extended to the data base and the interfaces: texts may now use characters of the complete Unicode set.
- Interfaces are added to manage external files by an ODS server without the need for shared drives or FTP connections.
- Changing/accessing information can be uniquely logged by an ODS server.
- Bit-based access to binary files is available, including data types like 12-bit integers.
- An application model for bus data was added, describing how to store messages sent via CAN, LIN, FlexRay, MOST, or Ethernet.
- Mass data may now be searched on the server side, using API methods.
- Web services interface for simplified access of clients to an ODS server via HTTP.

QUALITY ASSURANCE

- A checker tool for ASAM ODS is available. It may be used to find errors in the underlying database as well as in ATF files.
- Cross tests are organized from time to time. They are open for all ASAM members and allow to check ODS-based interoperability of applications, thereby improving the quality of the standard.

STANDARD AUTHORS

Audi AG, AVL List GmbH, BMW AG, Cologne University of Applied Science, Daimler AG, EPOS CAT GmbH, HEAD acoustics GmbH, HighQSoft GmbH, HORIBA Automotive Test Systems GmbH, LMS International NV, Müller-BBM VibroAkustik Systeme GmbH, National Instruments Corporation, Porsche AG, Robert Bosch GmbH and Volkswagen AG

Japan ASAM Interest Group (JAIG)

Featured Standard

How to Use ASAM Standards – a Collaborative Learning Approach

SUMMARY

Since 2009, representatives from large Japanese OEMs, such as Honda, Toyota, Nissan, Mazda, Suzuki, Mitsubishi, Fuji Heavy Industry, Daihatsu and Hino, debated the use and potential benefits of international standards in the area of ECU development and testing. They each independently recognized that the use of standards could be beneficial in terms of connecting different departments and remote development sites, to improving work flows with their suppliers and ultimately to breaking out of the narrow boundaries of in-house, custom-made tools that all too often are high in costs and low in features. ASAM standards have been quickly identified as leaders in the embedded tools area and became a focal point of interest.

Before committing to ASAM standards, Japanese OEMs needed to understand the content of the standards and their application in practice. The main question was if and how ASAM standards could be used on an enterprise level.

Solution: As the information provided in the standard documents were not sufficient to evaluate their potential for Japanese OEMs, a group of nine OEMs, six Tier-1 suppliers and 32 tool vendors formed the Japanese ASAM Interest Group (JAIG) with the purpose to:

- Figure out technical issues and use-cases that are common among the JAIG members
- Jointly learn relevant ASAM standards and understand their application
- Promote a local tool supplier base in Japan that is knowledgeable about ASAM Standards

The members of JAIG quickly identified the areas of Test Data Management, Automated Testing and Measurement & Calibration as the major points of interest for their work. Training sessions were organized for the ASAM MCD standards, ASAM CDF and ASAM XIL. Tool demos from vondors and technical discussions helped to become familiar with these standards. Additional tool demos from vendors and discussions on common technical problems were enough for the members to become familar with these standards. For other, more complex standards, a pilot implementation of a tool or tool-chain was set-up to understand its application. This article describes the pilot implementation for ASAM ODS.

Key Benefits: This joint and thorough approach not only guarantees a deep understanding of the benefits and limitations of the standards, but also creates acceptance both inside the company and among the network of Japanese OEMs and their suppliers. JAIG may be seen as a role model for other regions to get up to speed with standards and to quickly draw benefits from them in the day-to-day development activities of automotive companies.

SITUATION

ASAM ODS in particular is a complex standard that is IT-driven and thus difficult for engineers with little or no IT-focus to understand. This standard requires practical experience to understand its full capabilities. However, Japanese OEMs have identified this standard as a powerful tool to make better use of data both on micro (department) and macro (enterprise) levels.

SUCCESS STRATEGY

One of the primary success factors of JAIG is the paradigm of collective learning in a community. Specialists in one technical area with alike interests met regularly and worked jointly to learn, understand and apply the standards of their professional area. It soon became clear that learning via presentations was not sufficient to understand the benefits and limitations of ASAM ODS. The group members called for real life scenarios. Therefore, it was decided that as a second step a real use case to demonstrate the abilities of ASAM ODS should be prepared. Although Japan has no tradition in this kind of cross-company collaboration, this approach worked quite well. The group succeeded in setting up a prototype ODS server and was able to try out its functions and understand the benefits of ASAM ODS.

Step 1: LEARNING: The following objectives have been determined for the work group during the phase of studying the standard:

- Learning and understanding the basic terms and structures of ASAM ODS, such as the ATFX file structure, the usage of MIME types for complex engineering data, the base model, application model and the ASAM ODS API;
- The set-up of an environment for a model-based development system. The task was to integrate validation data on an enterprise level as well as to allow integration of CAE and CAT;
- The group wanted to get an idea of the ASAM ODS solutions available in the market and what it meant for local companies to invest in the standard to create a local eco system of tool vendors in Japan.

Experts from Germany and India conducted initial training sessions. Real use cases were demonstrated and explained. These experts also helped the group define a use case that covers all basic concepts of ASAM ODS such as ATFX file, MIME type, application models, etc.

Step 2: PILOT PROJECT: For the pilot project an example in the area of noise, vibration and harshness (NVH) was used. Using an example from this area seemed to have several advantages:

- NVH already provides a precise definition of engineering data such as octave analysis, order analysis etc;

Kaoru Aoki
HONDA R&D Co.,
JAIG moderator

- It provides the possibility to store measurement conditions and measurement points along with test data that can be reused for CAE;
- An NVH use case allows data sharing between different departments and different tools;
- Many important NVH tool vendors offer ASAM ODS compliant tools.

In order to see the benefits of the reusability of data, the use case focused on connecting enterprise level metadata to test data.

According to the agreed use case, a test ODS cloud server was set-up and maintained by PVMsys. The OEMs provided NVH sample data. Further data from tools were imported into the ODS server. Based on that set-up, different tool vendors demonstrated the connectivity of their tools to the data, proving that the system works well with all ASAM compliant tools.

The solution provided all next generation technology: it used an ODS server in the cloud, a smart importer for different data and provided connectivity of tools via a VPN connection. A special web application was implemented as user interface.

CHALLENGES

The work group faced some challenges throughout the project. The main challenge was to convince the OEMs to provide NVH sample data. Another challenge was where to host the ODS demo server; thus the idea of using a cloud-based solution was born. Third, IT security barriers had to be overcome in each company. VPN connections to external servers were blocked at most OEMs. Providing dedicated laptops that could then connect to the cloud server solved this problem.

Other challenges identified during the project include:

- The standardization of engineering metadata
- How to build an eco-system around ASAM ODS with Japanese tool vendors providing ASAM compliant products
- How to convince management to invest in processes around ASAM standards and products

Although the major work is done, some issues that the Pilot Project Work Group wants to further examine remain:

- Carry out performance benchmarks with different solutions;
- Investigate the possibility of ODS server clusters that connect on an enterprise-level.

“The collaboration in workshops and study groups helped every participant enormously to understand ASAM standards and how to apply them in practical use-case scenarios. We are thankful to the tool suppliers and to ASAM in Germany for their support. For us, as an OEM, it is important that this knowledge further increases in Japan and leads to a domestic supplier-base that uses standards in their products and services. We believe that then the benefits of standards will fully materialize.”

JAPAN ASAM INTEREST GROUP (JAIG) Members

BUSINESS BENEFITS

The main advantage was the fact that the entire community could learn about and understand a complex standard.

- They were able to learn about the usage of ASAM ODS both on the macro and micro levels: On an enterprise level, ASAM ODS helped streamline processes of the whole company. On a department level, it helped to use data more effectively in various tools thus increasing the availability and value of the existing data.
- An ASAM ODS based solution helped with inter-department communication.
- The project demonstrated that CAE – CAT integration is possible and reduces development time.
- The project also identified a new approach called product validation management (PVM).

MTU Aero Engines AG

Featured Standard: **ASAM ODS**

ASAM ODS Used in Multi-National Development of the Turboprop Engines for the Airbus A400M

SUMMARY

The Airbus A400M is a European joint project to develop and produce a military transport aircraft for tactical airlift operations. The maiden flight of the A400M was in December 2010 and the first aircrafts are being delivered to France in 2013 and Germany in 2014. The technologies used in the A400M are considered to be a bridge to the next generation of civilian aircrafts. This is specifically true for the advanced TP400-D6 turboprop engine. With a maximum output of 8,203 kW, it is currently the most powerful single-rotation turboprop engine in the western world. Despite its power, it is very fuel efficient for its class.

The TP400-D6 turboprop engine is developed by Europrop International GmbH, a joint-venture of MTU Aero Engines, Snecma, Rolls-Royce and Industria de Turbo Propulsores. The TP400-D6 is a complete new design developed from scratch. To enable the partnering companies to carry out this collaborative development project, they had to set up processes and data exchange methods that allows efficient cooperation in this ambitious project. ASAM ODS turned out to be an important part of this endeavor.

SITUATION

The construction of an engine starts with finite-element models and calculations of the solidness and stability of the construction. Tests with prototype engines have to be carried out to optimize the engine design, to validate the calculated robustness of the construction and to ensure that limits are not exceeded. A significant portion of this are NVH-tests that require to dynamically measure acceleration, vibration speed, strain and pressure. Sample rates reach up to 102 kHz. The amount of data produced in such tests is enormous and easily reach terabytes of size.

The joint-venture companies were soon confronted with the question how to exchange test data among each other. Each partner uses its own types of sensors, measurement systems and data storage formats, provided by different tool suppliers. Furthermore, tests are carried out at different locations. The resulting test data then has to be transported to other locations for post-processing and evaluation. The involved companies had to come to an agreement how to share and exchange the data in an efficient way to keep this project manageable. Since each company works with proprietary systems, there was no obvious answer to this question.

SUCCESS STRATEGY

From the beginning of the project, MTU Aero Engines and its tool supplier Müller-BBM VibroAkustik Systeme proposed to use ASAM ODS for exchanging test data. The standard offers two essential components that are needed by all partners:

- an NVH application model, which provides a semantic definition for the test data
- an XML-based file format (ATFX) for data serialization and file-based data exchange

The tools from Müller-BBM are aware of the ASAM ODS NVH application model and have an importer and exporter for the ATFX-file format. Since all other system suppliers agreed to the ASAM ODS, the partners settled on ASAM ODS as the standard for test data exchange. The most important reasons for their decision were:

- long-term stability of the standard: no frequent changes of file formats, which would jeopardize interoperability of tools and potentially causes loss of data
- public standard: fully documented file format and tool-vendor independence
- availability of tools: sufficient support of the standard by COTS products

Based on this decision to use ASAM ODS, the partners made further internal agreements to exchange raw, time-series data and to use a specific catalog of units. Since every company required additional data to be stored along with measured raw data, the ASAM ODS NVH application model was extended by each company with their specific meta data. Data exchange between the four partnering companies now had a solid foundation.

CHALLENGES DURING THE PROJECT

Once the decision was made for using ASAM ODS, it still took about a year to develop ATFX importers and exporters for all tools used by the joint-venture companies. Software engineers engaged in the development of the tools mentioned that the standard is quite complex and not easily understandable, but also acknowledged that it is a solid and well-thought-out standard. Once this challenge was overcome and the tools were developed, data exchange worked seamless between the involved companies.

Egon Preinesberger

Senior Manager Special Measurement Techniques,
MTU Aero Engines AG:

"The multi-national European project TP400-D6 turboprop engine forced us to find a common standard for test data exchange. ASAM ODS was the right standard to help us solve this problem. The standard enabled us to implement a test data exchange infrastructure between the joint-venture companies just in time when it was needed."

As expected at the beginning of the project, the amount of data produced for testing the TP400-D6 turboprop engine was enormous. MTU Aero Engines produced about 10 terabytes of NVH test data throughout the project. This amount of data could not be transported via the Internet for cost and security reasons. The data was stored in ATFX-files of 2 to 10GB of size, saved on hard disks and then sent via express mail to the other partners for further use.

BUSINESS BENEFITS

This seemingly low-tech method worked flawless and proves that big technical challenges between companies can actually be solved once they agree on the use of common standards. The joint-venture companies continue to use internal and proprietary databases within their own companies. But with the agreement on using ASAM ODS, they were actually able to exchange test data between them without having to spend major efforts in data conversion or maintaining data quality. Without using a public standard such as ASAM ODS, the companies would have to develop their own standard for their joint-venture project and would probably be still negotiating the technical details until today, when the project is almost finished. ASAM ODS significantly accelerated this process and allowed to implement a data exchange infrastructure that was ready in time when it was actually needed.

Aero Engine TP400-D6

OUTLOOK

The initial effort to introduce a data exchange format in the European aircraft engines industry is done. From the perspective of MTU Aero Engines, it would just make sense to continue to use ASAM ODS on a European scale and to further benefit from the established data exchange infrastructure. MTU Aero Engines also plans to use ASAM ODS as an internal standard for data exchange and intends to propose the use of ASAM ODS with his business partners Pratt & Whitney and GE in the US to gain the same benefits.

EPI Europrop International GmbH was created by four leading European aero-engine companies to manage the TP400 engine program.

Detroit Diesel Corp.

Featured Standards: **ASAM MCD-2 MC, ASAM MDF**

Tool migration using ASAM MCD-2 MC

For over 70 years, Detroit Diesel has designed and built the heavy-duty engines that fuel commerce and transportation across North America and around the world. The engines power a wide range of heavy-duty vehicles. To ensure the high level of quality and reliability of its engines, Detroit Diesel carries out extensive testing before they go into production. This includes on-vehicle testing on test tracks and public roads. Continuous logging of data from powertrain controllers and subsequent evaluation and analysis of the data plays a vital role in this process.

SUMMARY

Challenge: Daimler Trucks North America with its subsidiaries Freightliner and Detroit Diesel used a variety of tools to log data from its engineering vehicle fleets. Due to the lack of having a common data format and ability to log measurements from more than 20 CAN based devices, another tool was needed for recording and displaying data.

Solution: A new tool has been identified and the first migration phase has been successfully completed. The main interest for this Case Study is logging data; other capabilities from the tools described are irrelevant.

Key Benefits: The migration process has been very smooth because all tools are compatible with ASAM a2l files. Without being much aware of it, Daimler Trucks North America is benefiting from ASAM standards by having common data formats and using interchangeable software tools.

SITUATION

Freightliner and Detroit Diesel operate 3 truck fleets:

- Reliability Growth, verify functionality of production intended hardware and software.
- Chassis validation, main focus is hardware and software development related to vehicle systems. In order to calibrate for different environments such as sea level, high altitude, hot ambient and cold ambient, part of this fleet undergoes remote testing during summer and winter.
- Powertrain validation; similar objective as Chassis validation with the exception of focusing on powertrain systems instead of vehicle systems.

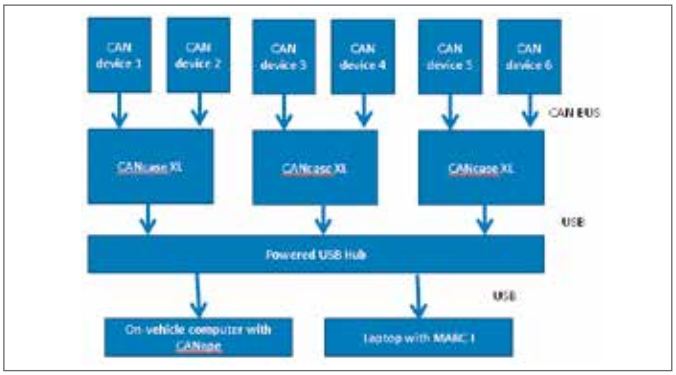
Freightliner and Detroit Diesel need the ability to handle data streams from multiple connected devices and show live data from 100's of channels, which are displayed on a 50" screen inside a class 8 sleeper cab vehicle.

TOOL USAGE PREVIOUSLY:

Fleet	Tool	MDF format	Display data	*.a2l compatible	20+ Devices
Reliability Growth	CANcase	yes	no (net needed)	yes	yes
Chassis validation	CSM	yes	no	yes	no
Powertrain validation	MARC I	no	yes	yes	no

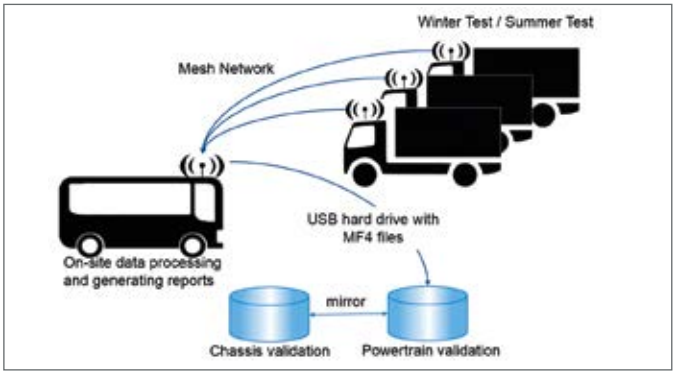
None of the existing tools were able to handle all tasks. In addition, having one common tool would ease the process of managing and sharing configuration, training and measurement lists.

Vector CANcase XL modules are used as the interface between the CAN bus and data loggers.



CAN to USB Interface

During remote testing, all data is saved on a server that resides within a modified coach bus for post processing. The bus is equipped with a mesh network that automatically receives data from nearby vehicles.



High level data architecture remote testing

Chris Niessen
Senior Engineer, Powertrain Integration,
Detroit Diesel Corporation

"I support ASAM because it enables plug and play of software tools"

The main processing modules are for engine, aftertreatment, transmission and chassis. In addition, other modules handle tasks such as instrumentation and fault code management, adding up to 20 modules.

SUCCESS STRATEGY

None of the existing tools were able to connect 20+ devices, log data in MF4 format and display live data. A new tool was needed for recording and displaying data.

Vector CANape can handle all required task and it is compatible with ASAM *.a2l files. ASAM MCD-2 MC (aka ASAP2) defines a description format for internal ECU variables used for measurement and calibration purposes. Any replacement data logger had to be compatible with a2l files because they are also used with MARC I, CSM and CANcase. Most engineers are not aware that the ASAM MCD-2 MC standard plays a major role in making this a smooth migration. No adjustments have to be made to the existing *.a2l files.

TOOL USAGE POST MIGRATION:

Fleet	Tool	MDF format	Display data	*.a2l compatible	20+ Devices
Reliability Growth	CANcase	yes	net needed	yes	yes
Chassis validation	CANape	yes	yes	yes	yes
Powertrain validation	CANape	yes	yes	yes	yes

The migration timeline includes a dual phase where both legacy and CANape recorders are simultaneously active. Phase 1: Ramp up Powertrain validation usage of CANape and keep logging data with MARC I. This dual-phase ensures that no data is lost during any unanticipated problems with CANape. After this short period of time, MARC I logging is stopped. In a similar approach, Phase 2 replaces the CSM loggers at Chassis validation, which is currently in the dual logging phase. The Reliability Growth fleet continues to work with CANcase loggers who have a similar functionality as CANape without the ability or need to display live data.

CHALLENGES

It took 1 year of testing and validation for the implantation at the Powertrain validation. CANape runs on a rugged dedicated in-vehicle computer. Due to the high demands on the CPU initially running constantly on 100%, the in-vehicle computers had to be upgraded twice to newer and more powerful models, currently running on the 3rd iteration. In addition, the heavy burden on the CPU was furthermore reduced by limiting the number of simultaneously recording channels at various sampling rates to currently 1073.
Many engineers became accustomed to .famos files recorded in MARC I. Since CANape stores data in ASAM MF4 format, some engineers are reluctant to use CANape recordings and still use MARC I on occasion for secondary data logging.

Although running without issues, the Chassis and Powertrain validation fleets are considered to be a high level user within Vector, testing the upper limits of the system with currently 20+ connected devices.

BUSINESS BENEFITS

- Ability to display and record 20+ devices
- Increased program robustness has ensured that very few measurements are lost during recording outside of normal program issues (operating system crashes, driver initialization error, memory overrun, etc)
- Measurement files are captured in ASAM MF4 format, increasing the number of tools that can process fleet data:
  - In-house data mining tool based on Matlab that was previously only compatible with Reliability Growth and Chassis validation.
  - Automated jBEAM report generator
  - Uniplot, CANape, DIAdem, ASAM ODS, etc.
- CANape allows loggers to be controlled by scripts, eliminating the task of manually triggering logs and coming up with measurement filenames on the fly by having a standardized naming convention
- Added data transparency by having rich, descriptive metadata about Vehicle, configuration and route in each file header by entering information into a custom CANape panel

OUTLOOK

The migration process is nearly completed. Due to the ever increasing number of devices and measurement channels, more powerful in-vehicle computers are needed with USB 3.0 interface to accommodate additional data throughput.

HighQSoft GmbH & Robert Bosch GmbH

Featured Standard: **ASAM ODS**

Integration of an ASAM ODS Analysis Server for Automated Measurement Data Evaluation

SUMMARY

Challenge: At Robert Bosch GmbH Diesel Systems, measurement data has become large scale; the number of files and data volume has skyrocketed. Today, engineers and experts in the domain are losing time and resources by manually developing and executing duplicate analysis programs, which they run only once, locally, on their hard-drives. In 80% of the cases, the tasks are repetitive as they inherit standard data validation and evaluation.

Solution: The approach to a solution was identified by integrating an analysis framework into the existing system architecture of the Product Lifecycle Management Database (PLCD), which includes an ASAM ODS database for measurement data management. The server-side framework defines and provides a workflow, which integrates automated evaluation calculations based on, for example, DIAdem scripts, MATLAB scripts or pure Java.
The concept of the analysis server enables the system to register ASAM ODS server event notifications and combine them with measurements of a defined MIME-type and a corresponding, predefined third-party tool evaluation.

Key Benefits: The key benefit of the analysis server is that it takes away most of the repetitive analysis tasks from the engineers, thereby allowing them to spend their time on specific evaluations. In addition, analysis results, such as reports, are generated in a standardized manner and remain comparable for further evaluation within ASAM ODS. Next to being able to process large-scale measurement data in a fully automated manner, the solution enables a convenient approach for evaluating characteristics over multiple tests.

SITUATION

The PLCD project at Bosch started with the Automotive Diesel Systems Department and is to be rolled out throughout the corporation. It currently covers multiple test stands for injector testing but is designed to cover other domains in the future.

The current implementation of the PLCD project runs in a productive ASAM ODS environment and is very advanced in data acquisition, data preparation and validation; it also integrates a web-based front-end data management and work-flow GUI. Although these steps are already up and running, the focus is on improving the process of evaluating managed data.

As of now, evaluations are mostly done by downloading files from the ASAM ODS server to a common shared drive to then process it further. As a requirement for the year 2015, Bosch wants to standardize this part of the work-flow in order to provide an overall streamlined solution to their internal costumers.

The idea of integrating an analysis server with PLCD was primarily influenced by the proof-of-concept at Daimler AG, where such a system for road-load data analysis has been running well in a productive environment since 2010; that system was partly developed by HighQSoft GmbH. The objective for Bosch is a re-launch of the concept with a generic implementation that incorporates lessons learned, new requirements and features.

CHALLENGES

Saving measurement data on a shared drive led to two major problems: first, the download of files from the ASAM ODS server onto the shared drive created redundancies and second, diversified analysis scripting led to varying implementation and non-comparable results.

These two problems created inefficiency in the following ways:

- Repetitive tasks occupied the employees' time and prevented them from focusing on their "actual work." In addition, the number of analyses to be executed was rising faster than employees could track. Finally, the resulting data was not properly fed back into the ASAM ODS system; therefore, comparison of analysis results was not feasible.

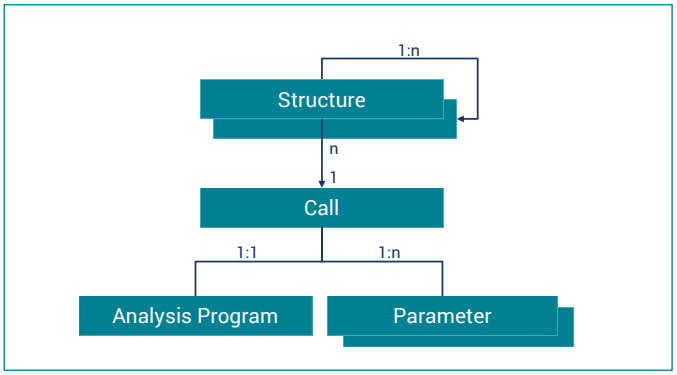
- These challenges led to the decision to implement a server-side framework to integrate automated execution of evaluations. The objective is to process new and incoming ASAM ODS measurement data based on their MIME-type and pre-defined analysis programs in order to retrieve standardized and comparable result sets.

Uwe Mannsperger
Robert Bosch GmbH

"The semantic description of measurement data in ASAM ODS is an inevitable prerequisite for automated and targeted analysis, as we plan to do it with our prospectively even larger scale data."

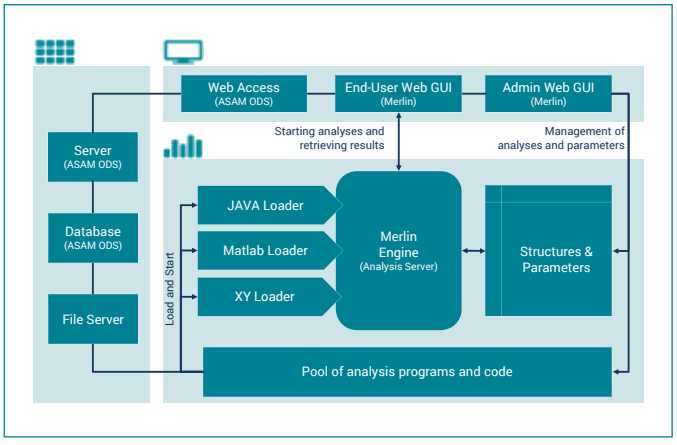
SUCCESS STRATEGY

We solved the aforementioned problems by implementing an analysis server application based on the ASAM ODS standard. The analysis server manages workflow by executing an evaluation. Its tree-like structure incorporates calls, analysis programs and parameters.The analysis program itself is a third-party script to be run by the analysis server with the third party's tools, such as DIAdem, MATLAB or pure JAVA.



Schematic representation of entities and relations of an evaluation

The result of an evaluation might be multifaceted and depend on the engineers' case-by-case requirements. An evaluation may produce simulated measurement data rewritten into ASAM ODS, evaluation reports to be attached to instance elements or a notification sent to a user group.



Schematic architecture of the analysis server and its integration into ASAM ODS

A web interface also allows engineers to administer analyses programs and their parameter sets for automated scheduling. In addition, they may retrieve results and are also able to trigger specific evaluations.

CHALLENGES DURING THE PROJECT

An additional challenge related to the manual measurements downloads and individual analyses is that the data volume on the shared drives grew exponentially. Due to the large number of files, we have developed a tool to support the identification of redundant data on ASAM ODS and on the shared folder. The tool allows an administrator to set up searches to identify, copy, move and/or delete the files based on various comparison modes. The administrator can dispense with the data according to the company's data guidelines. This tool is available on a web interface.

BUSINESS BENEFITS

The integration of the analysis server and the setup of an automated data workflow could significantly reduce the efforts of engineers to work through redundant tasks. The solution increases the quality of result sets through standardization, thereby enabling comparability.

As evaluation structure may be defined very flexibly. Moreover, an evaluation may contain multiple subsequent analysis programs and integrate multiple measurements into, for example, fleet analysis. Therefore, the solution meets the requirement of Bosch to be reused in different domains.

Another important fact is that the solution is designed to provide the workflow to automate data analysis; the know-how of the analysis is to be provided by the individual engineers and therefore stays within the enterprise.

In terms of IT infrastructure, the solution permits the analysis of large-scale data volumes right where they are produced. The scalability of the solution is given vertically (machine performance, CPUs and memory) as well as horizontally over multiple machines. Data traffic over networks and data redundancy on shared drives is reduced.

Müller-BBM VibroAkustik Systeme GmbH & AUDI AG

Featured Standard: **ASAM ODS**

Further Simplifying Pass-By Measurements

SUMMARY

Challenge

The complexity of exterior noise measurements (later called pass-by testing) and the amount of acquired data required for development, homologation and conformity, are continuously increasing because of stricter regional regulations. To overcome this challenge, highly automated procedures are implemented for the measurement and reporting tasks. In addition, a link to the existing IT infrastructures is established based on an open data format.

Solution

Fulfilling the complex task of pass-by measurements requires a close correlation between fully autonomous components and the integration of data analysis and reporting into existing IT environments. This is why state-of-the-art components, all designed to perfectly perform the required individual tasks, are integrated into the openMDM-based MeDaMAk system at AUDI AG.

Key Benefits

The open ASAM ODS ATF/XML format ensures a consistent data flow from the central assignment system via the acquisition, and later, either the interpretation or the integration of the data in simulations with minimal resource allocation. Information relevant to pass-by is incorporated into the ASAM ODS model. As the solution can be seamlessly expanded for diversified standards, long-term data accessibility and interpretability are inherent in the solution.

SITUATION

The increasing complexity of pass-by testing followed by time/cost pressure has made smart workflow systems the preferred approach to achieving the targets required. Over the past three years, AUDI AG has established a powerful pass-by measurement and analysis solution by combining PAK family components. These components have been embedded into the openMDM-based MeDaMAk solution. The PAK family members, PAK software and PAK edp, ensure easy, rugged and secure data acquisition and further interpretation. One may ask how this solution can be made even more efficient in the workflow? The answer is by combining the existing tools and defining interfaces as well as workflows.

CHALLENGES

The PAK family is a standardized solution for easily and efficiently determining a variety of exterior noise regulations and test scenarios. The PAK system has been connected to the company-wide openMDM platform in close cooperation with the AUDI AG Processes and Methods R&D Department.

All level values and additional quantities for comfort and driving dynamics acquired with PAK are stored in the central data management system, using the ASAM ODS ATF/XML standard. The acquired data can subsequently be viewed worldwide on the Intranet with PAK edp. Various data views are offered, ranging from the Lurban single-number values of homologation required by those responsible for production, to the level curve of the single runs or intermediate results, which provide the level of detail required for the development process.

This makes it easy to compare NVH-based levels, especially in the pass-by environment. Hence, PAK edp features the AUDI AG as an ideal benchmarking tool across the development of series, facilitating a powerful comparability of the development stages in the series. The context-based evaluations are configured from the customer's workflow, e.g., even different combinations of tires and exhaust systems can be easily compared.

SUCCESS STRATEGY

In order to master the increasing complexity in the existing environment, Müller-BBM VibroAkustik Systeme has developed intelligent, networked components.

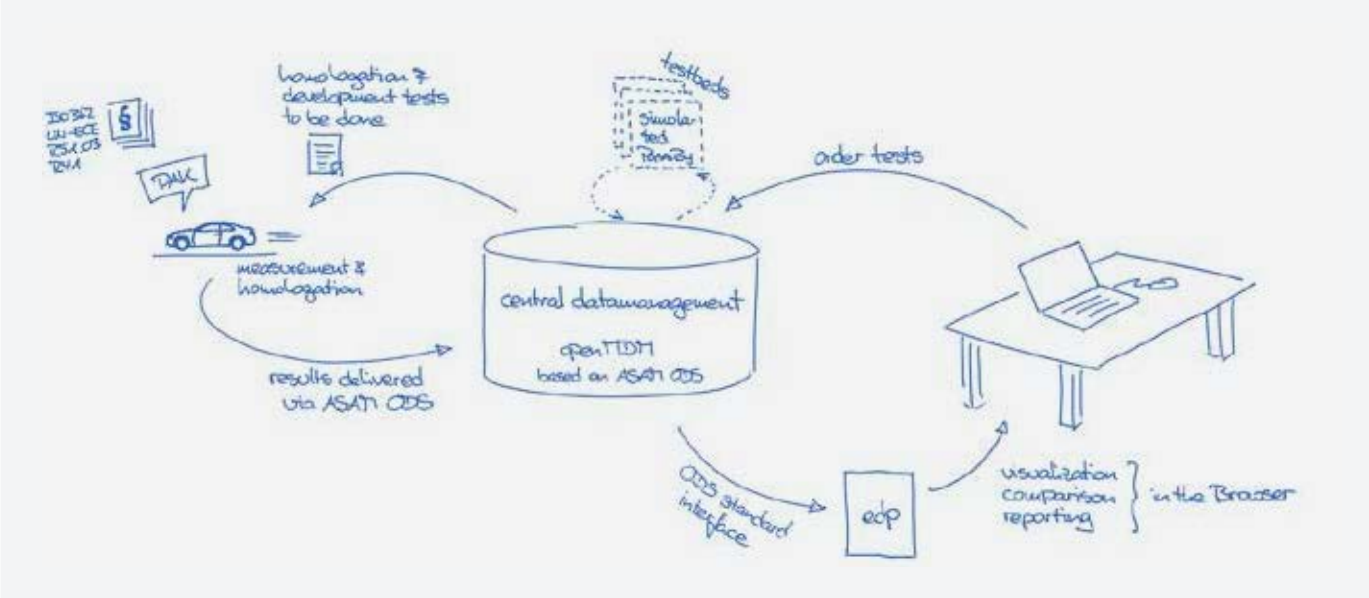
Equipped with such task-dedicated systems and supported by well-defined and standardized customer processes, users can simply focus on driving to perform perfect pass-by runs. As soon as the system is switched on, the PAK MKII data acquisition unit immediately provides all the available sensor signals live. Its stand-alone ability enables even a single operator to have all the necessary information always available online. Measurement results are safeguarded through improved data quality as well as by process automation in setups and driving. Due to the open ASAM ODS ATF/XML format, after a measurement has been finalized, users benefit from the barrier-free data exchange within their existing IT landscape. The results can also be compared with simulated pass-by or COP measurements based on the ASAM ODS standard.

Tino Teske
AUDI AG, Acoustics,
Type Approval and Exterior Noise

Christian Rechner
AUDI AG,
CAT Processes and Methods R&D

"The ASAM ODS based storage helps me to manage all my test data from pass-by-noise, testbed and driving measurements in one single system. Everyone of my colleagues now has the possibility to choose their tool for reporting and post processing, no matter the source data format."

"The standardization of process and data management was established years ago and is continuously being further developed, based on ASAM ODS."



Pass-By measurement workflow

Despite the component-based approach, the integrity of information is always assured. The consistency of all the components defines the high degree of freedom in the workflow. Users benefit from sustainable information. The ASAM ODS standard enables data to be viewed independent of a manufacturer and/or device.

CHALLENGES DURING THE PROJECT

Exterior noise measurements are challenging tasks that require both solid data transparency and easy data management from the assignment to the measurement up to the report. What is exceptional for the pass-by measurements is that the parent process is split into several independent tasks, for example for the driver, the central system or reporting. This allows the task to be broken down into all participating labor shares and software building blocks. No matter what components are chosen, all information has to be consistently merged again at the end.

BUSINESS BENEFITS

The PAK family solution offers an easy workflow for the complex exterior noise procedures in the environment of the increasing portfolio of series and variations within series. This pass-by solution is consistent over the different stages of test specification, the test procedure, and up to the test report. Coupled with high temporal and cost efficiency, the process safety remains constant over versatile user characteristics. Moreover, it is extremely robust against external failures.

Applying best practices, standalone components have benefits such as single-user operation or the simultaneous measurement of multiple vehicles on the test track; thus the cost of the measurement can be reduced as measurement campaigns can take less time and the capacity of the test track can be completely utilized. All data is fully integrated into the existing as well as the newer IT infrastructures owing to ASAM ODS.

dSPACE GmbH & Tula Technology

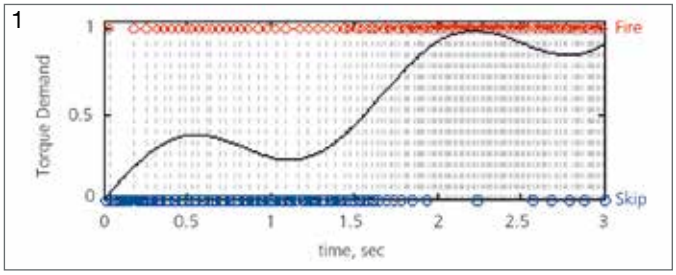
Featured Standard: **ASAM HIL**

Dynamic Firing Order

Dynamic Cylinder Deactivation Improves Engine Efficiency

Imagine a combustion engine where each cylinder can be fired variably or skipped to provide the torque demanded by the driver. The engineers at Tula Technology, headquartered in Silicon Valley, have made this vision a reality and are expecting a series production with several OEMs.

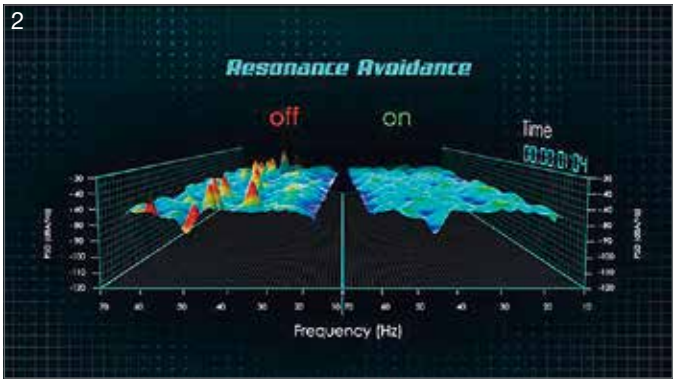
Dynamic skip fire (DSF) is the name of the new technology at Tula. By deciding if and when each individual cylinder is ignited, DSF enables a particularly efficient engine operation. The engine control determines the number and sequence of cylinders that need to be fired in order to provide the required torque (*figure 1*).



Dynamic Skip Fire decides when to fire each cylinder.

Dynamic Firing Increases Comfort and Efficiency

One of the biggest concerns involved in cylinder deactivation lies in deploying production-ready NVH (noise, vibration, harshness) powertrain behavior. To make this possible, intelligent algorithms developed by Tula avoid unfavorable frequencies, thus ensuring a comfortable driving experience at any time. By continuously timing the firing order, the DSF avoids resonance frequencies, thereby obtaining noise suppression and vibration reduction (*figure 2*).



Intelligent algorithms avoid resonance frequencies, thereby optimizing driving comfort.

Cost-Effective Solution

Among the low-cost, fuel-efficient technologies available on the market, DSF is the most efficient with fuel savings of up to 20%. Another advantage is its compatibility with other fuel-saving technologies such as direct injection, turbocharging, start/stop systems, and mild or full hybrids. Several OEMs and Tula are working together to get the technology ready for series production.

Development Tasks for Practical Use

Tula's main strength is in algorithms for variable cylinder deactivation and NVH suppression. To demonstrate the practical feasibility of the algorithms, the algorithms need to be implemented and executed in a demonstration vehicle. This is done with a prototyping system that controls a GMC Yukon Denali V8 engine. But before the algorithm is used on a real engine, it must undergo functional validation first. Hardware-in-the-loop (HIL) is the best test environment for this. To reduce the overall development time up to completion of the quality assurance (QA) tests, the HIL system should also be available for development tasks. Both the software developers and the testing and QA engineers must have access to the HIL test bench. In addition, the HIL test bench must be acessible from several locations.

Combined Tool Chain

To run the prototype of the DSF technology on customer platforms, Tula chose dSPACE's rapid prototyping tool MicroAutoBox II.

To validate the functions of the controller software, Tula developed a HIL test bench that uses the current ASAM HIL API (ASAM = Association for the Standardisation of Automation and Measuring Systems).

The HIL test bench receives the analog and digital I/O signals from the hardware and software of a third-party engine simulation. The engine simulation also transmits the crank and camshaft signals to dSPACE MicroAutoBox II, which in turn executes the DSF software. dSPACE AutomationDesk is the test management tool for performing the tests on the DSF software. All the components and AutomationDesk communicate through a common interface.

James McKeever
Senior Embedded Software Test Engineer,
Tula Technology, Inc.

"Our goal is complete automation for the tests. That is why we use dSPACE AutomationDesk with the ASAM HIL API."

Challenge for the Combined Tools

Several different processes had to be combined to ensure a reproducible and reliable process: retrieving the source code and automation test scripts, compiling the source code for the test benches, loading executable files on the target HIL test bench, executing automated test scripts, generating summaries, and archiving the results for review and auditing.

Automation to Reach the Goal

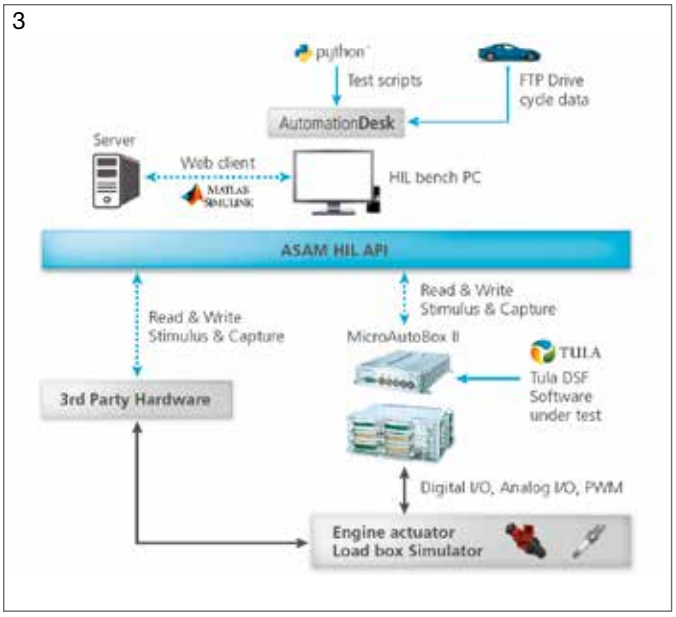
To implement the process steps, Tula created suitable software solutions. The first solution combines the engine simulation with dSPACE MicroAutoBox II via AutomationDesk as the framework for test automation. The implementation is done using the current version of the ASAM HIL API standard. With the HIL API, the Python-based test scripts can be written and executed as AutomationDesk test cases.

All test cases are available as AutomationDesk projects, which can be executed on the HIL test bench in both closed and open loop. This is usually done when implementing existing fuel test profile (FTP) vehicle cycles. In AutomationDesk projects, it is also possible to collect and record data for the test cases, compare this against predefined pass-fail criteria, and generate comprehensive reports on the performed test runs.

WebCarLab – The Optimal Solution

To ensure that the tests are performed from a central source code storage and to enable multiple remote access to the HIL test bench, Tula developed the web-based test automation tool WebCarLab (*figure 3*). The application communicates with a software configuration management (SCM) system and provides a web interface. WebCarLab has an intuitive user interface that lets users to run tests on the HIL test bench either interactively or in batch mode (batch processing). After the user has chosen a mode, WebCarLab checks the code from the SCM system and performs the selected test cases. In addition to generating test reports, WebCarLab creates all the artifacts that lead to the test results and archives the test reports for future audits.

3



The web-based tool WebCarLab allows remote access to the complex HIL test bench.

Conclusion

Tula is using an automated HIL test bench to develop innovative functions for dynamic cylinder deactivation in internal combustion engines. On the test bench, the controller software is validated for in-vehicle use. With MicroAutoBox II, Tula implements the functions in the demonstration vehicle, reaching fuel savings of up to 20% without sacrificing ride comfort.

ASAM – your partner for standardization.

- 15 years of experience in standardization
- Well established and recognized organization for standards development
- High industry acceptance of ASAM standards
- Large ecosystem of tool suppliers

ASAM

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The Robert Bosch GmbH company and its employees are as from the very beginning partners of the ASAM e. V. We are involved in the definition of standards applicable to various topics being related to automotive control units. We will integrate the ASAM standards into our products according to our customers' wishes.

www.bosch.com

Continental Automotive GmbH

As a leading international supplier of automotive electronics and mechatronics it is essential to fully support industry standards instead of dedicated and proprietary solutions. Especially within the context of calibration, measurement, diagnosis and for distributed OEM-supplier development Continental relies on ASAM standards.

www.continental-corporation.com

Cummins Inc.

Cummins Inc., a global power leader, is a corporation of complementary business units that design, manufacture, distribute and service engines and related technologies, including fuel systems, controls, air handling, filtration, emission solutions and electrical power generation systems. Cummins earned $1.66 billion on sales of $17.3 billion in 2012.

www.cummins.com

DELPHI Corporation

As a leading international supplier of automotive electronics and mechatronics it is essential to fully support industry standards instead of dedicated and proprietary solutions. Especially within the context of calibration, measurement, diagnosis and for distributed OEM-supplier development Continental relies on ASAM standards.

www.delphi.com

DENSO Corporation

DENSO is one of the largest global automotive suppliers of advanced technology, systems and components, heading toward an automotive society where cars put less drag on the environment and drivers have fewer worries about traffic accidents. Everything we do at DENSO is based on our philosophy: "Contributing to a better world by creating value together with a vision for the future." This philosophy helps to make us a corporation that is trusted by people around the world.

www.globaldenso.com

Detroit Diesel Corp.

For over 70 years, Detroit Diesel has designed and built the heavy-duty engines that fuel commerce and transportation across North America and around the world. Our engines drive a wide range of heavy-duty vehicles, and now we're offering our own line of axles built with the same precise engineering and rock-solid durability you expect from our engines.

www.demanddetroit.com

Keihin Corporation

At a time of substantial changes in automobiles and motorcycles, Keihin is evolving with the aim of continuing to lead the world as a "manufacturer of integrated systems." We are further broadening our old perspective of pursuing the world's highest quality for individual parts by working on advanced integration of mechanics and electronics to achieve optimization in whole energy management systems.

www.keihin-corp.co.jp

Motorenfabrik Hatz GmbH u. Co. KG

Hatz is a specialist in 1 to 4-cylinder diesel engines which are used in all manner of applications, such as construction machinery, compressors and utility vehicles. Besides, Hatz produces components for the automotive industry and systems like pumps, generating sets and scalable electricity stations based on customer demand.

www.hatz-diesel.com

MTU Friedrichshafen GmbH

MTU is one of the world's leading manufacturers of large diesel engines and complete propulsion systems. Together with MTU Onsite Energy, MTU is one of the leading brands of Rolls-Royce Power Systems. Its product range is the widest and most modern in the sector. It covers diesel engines as well as complete propulsion systems for ships, for heavy agricultural, rail and military vehicles, and for the oil and gas industry.

www.mtu-online.com

TRW Deutschland Holding GmbH

TRW Automotive is one of the world's largest suppliers of automotive components and systems. One of the industry's top financial performers, TRW's global sales were $14 billion in 2010. Headquartered in Livonia, Michigan, USA, the Company, through its subsidiaries, operates in over 185 facilities in 26 countries and employs more than 60,000 people worldwide. TRW Automotive supplies both active, passive and integrated safety products to all major OEM vehicle manufacturers and their suppliers.

www.trwauto.com

ZF Friedrichshafen AG

ZF is a global leader in driveline and chassis technology with 121 production companies in 26 countries. In 2013, the Group will presumably achieve a sales figure of around €17 billion with 73,600 employees. In order to continue to be successful with innovative products, ZF annually invests about 5 % of its sales in research and development. ZF is one of the ten largest automotive suppliers worldwide.

www.zf.com

TOOL VENDORS

3-23-14, Higashi-Ikebukuro
170-0013 Toshima-Ku, Tokyo, Japan

Phone + 81 3 5391 6132
Fax + 81 3 5391 6148

www.aandd.jp

Offices
US info@aanddtech.com
EU info@aanddeurope.com (w/o GB)
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A&D Company, Limited

A&D Company specializes in measurement, control and simulation solutions for powertrain testing and vehicle development. Our open, flexible and cost-effective tools are designed to fit a wide variety of applications, from durability and performance to hardware-in-the-loop simulation and hybrid/electric vehicle development and testing. Our complete range of products includes torque transmitters (wheel, axle, drive plate), FFT analyzers, hydraulic testing systems, data acquisition and control and combustion analysis systems, as well as real-time simulation systems and model-based automated calibrations tools.

A&D Data Acquisition Products

Type	Software for engine/pow ertrain test cell automation systems
Functionalities	Automation system for engine/powertrain/EV/HEV test cells
ASAM Standards	ASAM ACI, ASAM MCD-3

A&D ORION

Type	Software automated ECU calibration
Functionalities	Automated calibration of ECUs on the test bed.
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-1 CCP, ASAM MCD-3

A&D Real-Time Platforms

Type	Development Environment for A&D-DSP system
Functionalities	Utilizing real-time OS, executing measurement, controls, real-time simulation
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-1 CCP

A&D Real-Time Software Development Environment

Type	Development Environment for A&D-DSP system
Functionalities	Model Builder, C or Execution Code Generation, GUI Generation, Execution System
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

A&D VirtualConsole

Type	Graphical User Interface (GUI) Designer
Functionalities	Arranging GUIs, Measuring values and graphs, linking with external applications
ASAM Standards	ASAM MCD-3

Contact: Mr. Takeshi Nakamura, Mail: take-n@aandd.co.jp

Berliner Damm 31
25479 Ellerau, Germany

Phone + 49 4106 7998 41
Fax + 49 4106 7998 22

www.ams-soft.de

A.M.S. Software GmbH

Since 1995, the A.M.S. Software GmbH develops flexible, extensible and long-lasting software and hardware products in close collaboration with their customers. We design and integrate systems for customers of many branches of industry. The main focus of our work lies in the

areas of instrumentation, control and automation (ICA), verification, visualization, archiving, databases and data management. We have comprehensive know-how in the system software LabVIEW as well as in other products of National Instruments. Among our long-time customers are well-known companies in the area of automotive, machine construction, aviation, semiconductors, electrical devices and domestic appliances.

A·M·S SOFTWARE GMBH
Erfolg durch nachhaltige Lösungen

ACANIS

Type	CAN Monitoring & Simulation
Functionalities	ACANIS - a universal software tool for CAN networks. ACANIS assists during the development of CAN-based systems by offering an integrated, interactive and ergonomic analysis and testing environment. ACANIS is dedicated to all National Instruments NI-CAN and NI-XNET interfaces. An easy-to-use bus simulation is also included and can be extended via LabVIEW by the customer. www.acanis.de
ASAM Standards	ASAM MCD-2 NET (FIBEX)

Contact: Mr. Peter Schwarz, Mail: peter.schwarz@ams-soft.de

Accurate Technologies, Inc.

ATI

Accurate Technologies Inc. (ATI) is a global, independent supplier of control system development tools headquartered in Wixom, Michigan, USA. ATI's portfolio of hardware and software products provides easy to use, customizable solutions to accelerate controls system design, rapid prototyping, in-vehicle calibration and network analysis.

47199 Cartier Drive
48393 Wixom, United States

Phone + 1 248 848 9200
Fax + 1 248 848 9016

www.accuratetechnologies.com

Offices
GB sales_uk@accuratetechnologies.com
SE sales_se@accuratetechnologies.com
DE sales_de@accuratetechnologies.com
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CANLab™ Network Analysis Software

Type	Multi-bus Network Analysis Tool
Functionalities	Complete solution for bus communication, data logging and data analysis via industry standard network protocols such as Controller Area Network (CAN) including J1939 and Local Interconnect Network (LIN). Includes a built-in CCP interpreter.
ASAM Standards	ASAM MCD-1 CCP

VISION Network Hub

Type	CAN and ISO 9141
Functionalities	Hardware supporting simultaneous calibration and measurement of memory emulated, CANCCP, ISO 9141 KWP2000 base controllers, and measurement of analog, thermocouple and pulse sensors (EDAQ required).
ASAM Standards	ASAM CDF, ASAM MCD-1 CCP, ASAM MCD-1 XCP

VISION™ Calibration & Data Acquisition Software

Type	Measurement and Calibration System
Functionalities	Support for simultaneous calibration of memory emulated, CAN CCP, ISO 9141 KWP2000 based vehicle electronic control units, and measurement of analog and thermocouple sensors. Includes advanced data analysis and export. ASAM MCD-2 MC and VB scripting interface. Platforms supported: Windows 98, NT, 2000, XP
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-3

Contact: Ms. Diane Rogers, Mail: drogers@accuratetechnologies.com

1594-8 Sukhumit Road, Prakhanong
10260 Klongtoie, Thailand

Phone + 66 86 2462446
Fax + 66 2 7564459

www.aimagin.com

Aimagin Company Limited

Aimagin Co.,Ltd. specializes in Simulink Blockset development for embedded system design using code generation and model-based design techniques. Our core product, Waijung Blockset, enables engineers to easily implement real-time networked (wire and wireless) or stand-alone monitoring and control systems. Waijung blockset supports such ARM Cortex - M series MCU as STM32 and nRF51x.

Waijung

Type	Embedded Software Development Tool
Functionalities	Simulink Blockset for Embedded System Development and Code Generation for ARM Cortex - M0, M1, M3 and M4
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L)

Contact: Mr. Krisada Sangpetchsong, Mail: admin@aimagin.com

Bahnhofstr. 6
09111 Chemnitz, Germany

Phone + 49 371 918668 10
Fax + 49 371 918668 99

www.AMSonline.de

Offices
US Peter.Kaub@jBEAM.de
CN Rui.Liang@jBEAM.com

AMS GmbH

AMS is the specialist for measurement and analysis of engineering data, especially data from test and simulation. The award-winning data processing software jBEAM is a platform-independent tool for data acquisition, analysis and visualization. AMS is intensively committed in the CEA and ODS standards.

AMS-ATF Importer/Konverter

Type	CEA Component
Functionalities	Import/export of ODS-ATF files, incl. extensive checking functionality
ASAM Standards	ASAM ODS

jBEAM

Type	CEA Framework for desktop usage
Functionalities	Complete area of data import, data analysis, and data visualization
ASAM Standards	ASAM CEA, ASAM ODS

jBEAM-Web

Type	Library for web based applications
Functionalities	Complete area of data import, data analysis, and data visualization
ASAM Standards	ASAM CEA, ASAM ODS

Contact: Mr. Bernhard Sünder, Mail: bernhard.suender@jBEAM.de

Datavägen 2,
43632 Askim, Sweden

Phone + 46 31 3012830
Fax +46 31 3012839

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ArcCore AB

Being one of the vendors providing AUTOSAR products to the automotive market, we bring a new way of developing and offering state-of-art products and services to the market. It can easily be described in three words: Standards, Open and Innovative.

BSWBuilder

Type	Tool
Functionalities	Configuration of Autosar BSW
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

Contact: Mr. Michael Svenstam, Mail: michael.svenstam@arccore.com

Autient, Inc.

Autient is an engineering services company specializing in automotive ECU software development and test systems.

Contact Mr. Tom Zagotta, Mail: tom.zagotta@autient.com

10050 Colonial Industrial Drive
48178 South Lyon, United States

Phone + 1 (248) 486-9900

www.autient.com

AVL LIST GMBH

AVL is the world largest privately owned and independent company for the development of powertrain systems with internal combustion engines as well as instrumentation and test systems.

CAMEO calibration environment

Type	Software for the automated calibration of combustion engines and transmissions
Functionalities	Online control of the calibration process and offline global modeling
ASAM Standards	ASAM ACI, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-3

CONCERTO Data Postprocessing Software

Type	For interactive & automated data postprocessing in automotive application
Functionalities	Data format conversion & management, data analysis, calculation & visualization
ASAM Standards	ASAM CEA, ASAM ODS

CRETA™ Calibration Data Browser

Type	Calibration Data Browser
Functionalities	The AVL CRETA Calibration Data Browser allows calibration engineers of engine and transmission control units to interactively visualize any control unit maps, curves and parameters while studying or reading the application note of a control unit.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

CRETA™ Calibration Data Management

Type	Enterprise Calibration Data Management for engines, transmissions and hybrid.
Functionalities	As a central calibration data management system of xCU parameters, AVL CRETA™ allows the central storage, conflict-free merging and traceable documentation of calibration datasets during series calibration projects.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

Hans-List-Platz 1
8020 Graz, Austria

Phone + 43 316 787 0
Fax + 43 316 787 400

www.avl.com

Offices
US infosales@avlna.com
DE avl.deutschland@avl.com
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iGEM Offline

Type	AVL iGEM Offline test data evaluation is an innovative solution for efficient data analysis of exhaust emission tests according to legislative demands
Functionalities	iGEM Offline includes a series of effective tools and offers the possibility for authorized users to change or expand an existing record configuration. The Formula Editor helps to change calculation variables and formulas and add them into the database. The configuration can be adapted to comply with new legislation or modified technical conditions. Report templates can be created and modified easily via drag and drop operations in the Report Layout Editor. Sever al different types of reports can be created besides the typical standard reports such as online and modal reports; specimen, equipment and consumable data record sheets; statistics COP and audit reports; testing series reports and also combinations of different types of reports.
ASAM Standards	ASAM ODS

PUMA Open Test Bed Automation

Type	Software for test bed automation for stand alone and networked environments
Functionalities	Automation system for engine, transmission/powertrain and chassis dyno test beds
ASAM Standards	ASAM ACI, ASAM CEA, ASAM GDI, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-3, ASAM ODS

SANTORIN Data Management Server

Type	Software for ASAM ODS compliant data storage, access and exchange
Functionalities	ODS Server for ODS data models, ODS data browser & Admin clients
ASAM Standards	ASAM ODS

Test Factory Management Suite (TFMS)

Type	Process data management software for test fields
Functionalities	Test request handling, Test equipment management, scheduling of resources, UUT management, reporting, utilization optimization
ASAM Standards	ASAM ODS

TestGate

Type	Web based software for remote monitoring of test fields
Functionalities	Graphical overview of the test field, overview of test beds and online values
ASAM Standards	ASAM ODS

Contact: Mr. Gerald Sammer, Mail: gerald.sammer@avl.com

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b-plus GmbH

Ulrichsberger Str. 17
94469 Deggendorf, Germany

Phone +49 991 270302 0
Fax +49 991 270302 99

www.b-plus.com

b-plus GmbH was founded 1996 in Deggendorf, Germany, and is an innovative provider of systems and development services. We offer automotive, automation and embedded systems solutions. We have a long term experience and significant know-how in project and product areas such as industrial networking, design of complex control system software or the design of embedded µController and PC hardware solutions. Various development teams realize sound solutions for sophisticated industrial and safety relevant automotive applications. b-plus

sees itself as a reliant full service provider, beginning with the well-founded consulting, the conception and the management of a project up to the realization and is thus the professional partner of the customer, beginning with the development phase up to the series production and system integration.

CANTucan

Type	CAN gateway and bus simulator
Functionalities	Designed for the use in development, test and diagnosis environment for communication networks in cars, trucks and laboratories - Fast and easy to use by complete tool based device configuration - Interactive configuration via USB or CAN - Tool chain integration by XCP (via USB or CAN) - ECU conform firmware and hardware architecture - Smallest dimensions and robust aluminum housing for on-board use - Reduced time to market and non-recurring engineering cost
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP

GiraBITE

Type	Universal flash-/parameterization-tool
Functionalities	Flashing of bootloader or firmware for updates of ECU software. Hardware independent support of various bus interfaces in production. - Configurable Flash processes, Use via command line or GUI support of different CAN and FlexRAY™ bus interfaces, ODX flash container
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-2 NET (FIBEX)

UNIBoot

Type	Universal Bootloader for ECUs
Functionalities	Security: Seed & key support, SafeMode according to ISO26262 - Hardware independent: support of various chip manufacturers - Configuration: static configuration, standard and extended CAN identifier - Update toolchain: UNIBOOT Manager
ASAM Standards	ASAM MCD-1 XCP

Contact: Mr. Alexander Noack, Mail: alexander.noack@b-plus.com

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BASELABS GmbH

The Baselabs GmbH is focused on the data fusion in multiple sensor scenarios. We provide software and consulting services for the implementation of advanced driver assistance systems (ADAS) and automated vehicles. The design of environment perception algorithms and the convenient provision of these algorithms to our customers is a key part of our offering. Exemplary customers are Bosch, Denso and Daimler.

BASELABS Code

Type	Code Generator
Functionalities	BASELABS Code is a prototypical C-Code generator to generate C-Code from a data fusion system that has been developed using BASELABS Create.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

Ebertstr. 10
09126 Chemnitz, Germany

Phone +49 371 337151 31
Fax+49 371 337151 33

www.baselabs.de

Offices
DE info@baselabs.de

BASELABS

BASELABS Consulting

Type	Service
Functionalities	Consulting for the implementation of complex driver assistance systems. Special focus on algorithm development for the environment perception.
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L)

BASELABS Create

Type	Software development tool for statistical signal processing algorithms
Functionalities	BASELABS Create provides sophisticated algorithms for driver assistance systems as ready-to-use components and allows new algorithm developments. It is suitable for all sensor-based driver assistance applications and increases the efficiency of the design process.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

BASELABS Modules

Type	Customer-specific software applications
Functionalities	With BASELABS Modules, we offer our customers software components in the field of data fusion and environment perception that are provided on a ready-to-use basis. Examples are multiple object tracking (MOT) applications or car-2-car (C2C) communication applications.
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L)

Contact: Mr. Norman Mattern, Mail: norman.mattern@baselabs.de

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瑞风协同 RAINFE

Beijing Rainfe Technology Ltd.

Zichun Road, 56, Zhonghai Building, 8 fl.
100086 Beijing, China

Phone + 86 10 670824 50
Fax + 86 10 821193 55

www.rainfe.com

Beijing Rainfe Technology Ltd. was founded in 2007. It is one of the top ten PLM solutions providers in China (according to Cimidata report 2010). The company focuses on design/simulation and testing solutions through its enterprise software platform and engineering tools. Beijing Rainfe's clients come from the aerospace, marine, defense, auto, and energy industries.

tdm3000

Type	Test data management system
ASAM Standards	ASAM ODS

Contact: Ms. Jinyi Liu, Mail: liujy@rainfe.com

DIGITEST 天健通泰科技

Beijing Tianjian Tongtai Technology Co., Ltd.

Room 601, Kehai Fuling Building No. 12 Zhong Guan Cun South Street Haidian District
100081 Beijing, P.R. China

Phone + 86 10 621694 60
Fax + 86 10 621694 65

www.digitaltest.cn

Beijing Tianjian Tongtai Technology Co. Ltd. Specializes in data acquisition, management, analysis and Enterprise Test Business Solutions for manufacturing sector. Our main product is 神鹰™ODS-based Data Acquisition Middleware, 神鹰™ TDM (Test Data Management), 神鹰™ LIMS (Laboratory Information Management System), Test Data Process and Analysis Solution, Enterprise Test Information Integration Solution.

神鹰™ TDM

Type	Software
Functionalities	Test Data Management
ASAM Standards	ASAM ODS

神鹰™ASAM ODS SERVER

Type Software
ASAM Standards ASAM ODS

神鹰™ASAM-ODS Data Acquisition Middleware

Type Software
Functionalities Data Acquisition, Data Monitor, File Format
ASAM Standards ASAM ODS

Contact: Ms. Fang Liu, Mail: liufang@digitaltest.cn

Berner & Mattner Systemtechnik GmbH

Berner & Mattner specializes in systems engineering, development and testing of complex electronic and mechanical systems. We are a strategic partner for our customer\'s development departments of the automotive, transportation, mechanical engineering, energy, space and defence industries and provide customized products and engineering solutions. In the automotive sector, we develop diagnostic and model-based ECU functions, distribute innovative tools, supply and operate test systems, design and calculate mechanical components/assemblies, offer safety and systems engineering, provide consulting on state of-the-art test methods.

Consulting for Diagnostic ECU specifications based on MCD-2D (ODX)

Type Consulting
ASAM Standards ASAM MCD-2 D (ODX)

Diagnostic Applications based on MCD-3

Type Application development
Functionalities DoIP, CAN, KWP2000, UDS, ODX, OTX, MCD-3 evaluation & verification
ASAM Standards ASAM MCD-3

Contact: Mr. Jürgen Meyer, Mail: juergen.meyer@berner-mattner.com

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BETA CAE Systems S.A.

BETA CAE Systems S.A. offers state-of-the-art CAE software systems that meet the requirements of all simulation disciplines, for many sectors, including the automotive motorsports and aerospace. The company's products, ANSA pre-processor, μETA post-processor, and SPDRM simulation-process-data-and-resources manager, hold a worldwide leading position.

μETA

Type Post-processor for FEA & CFD simulation results and test data.
Functionalities μETA provides an embedded ASAM ODS browser specifically designed to ensure flexibility, performance and ease of use in navigating and querying ASAM ODS data sources. It provides an overview to the data hierarchy included in the data model and a powerful query tool for retrieving data from the server. All functionality is also available through scripting thus, allowing the full automation of tasks involving interaction with ASAM ODS data sources.
ASAM Standards ASAM ODS

Contact: Mr. Dr. Sam Saltiel, Mail: ansa@beta-cae.gr

Erwin-von-Kreibig-Str. 3
80807 Munich, Germany

Phone + 49 89 608090-0
Fax + 49 89 6098182

www.berner-mattner.com

Offices
DE info@berner-mattner.com
(Berlin, Braunschweig, Cologne
Ingolstadt, Munich, Stuttgart, Wolfsburg)

Kato Scholari, Thessaloniki
57500 Epanomi, Greece

Phone +30 2392 021420 420
Fax +30 2392 021 828

www.beta-cae.gr

Offices
IT italy@beta-cae.it
SE nordic@beta-cae.se

Brüel & Kjær

Skodsborgvej 307
2850 Nærum, Denmark

Phone + 45 7741 2424
Fax + 45 4580 14 05

www.bksv.com

Brüel & Kjaer Sound and Vibration A/S

Brüel & Kjær is a world-leading manufacturer and supplier of sound and vibration measurement systems. Our focus areas are automotive businesses, ground transportation, aerospace, space, defence, airport environment, urban environment, telecom and audio. Brüel & Kjær has an unparalleled portfolio of sound and vibration measuring equipment and is a renowned deliverer of innovative instrumentation solutions.

ASAM ODS Connectivity

Type	8605
Functionalities	Data exchange using ATF/XML format
ASAM Standards	ASAM ODS

Contact: Mr. Torben Nielsen, Mail: torbeng.nielsen@bksv.com

C.L.GERHARTL
Smart Systems

Suhler Str. 8
38444 Wolfsburg, Germany

Phone + 49 5361 8686 0
Fax + 49 5361 8686 86

www.smart-crosslink.de

C.L.GERHARTL Smart Systems GmbH

C.L.GERHARTL Smart Systems focusses on hard and software development for the automotive industry. The company offers consultation and engineering services, and tools for the development of complex embedded system networks. C.L.GERHARTL Smart Systems also provides the complete development of testing devices and tailored software. C.L.GERHARTL Smart Systems applications are also used in industry and research.

CL-S21

Type	Embedded system
Functionalities	Data logger, Gateway CAN, LIN, A/D
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MDF

CL-S42

Type	Embedded modular system
Functionalities	Data logger, Gateway, control system, rapid prototyping system
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MDF

Contact: Mr. Jürgen Roser, Mail: juergen.roser@gerhartl.de

CAETEC

Industriestr. 1
82140 Olching, Germany

Phone + 49 8142 501360
Fax + 49 8142 501369

www.caetec.de

CAETEC GmbH

CAETEC is one of the leading companies in developing data acquisition hardware like data loggers and measuring devices for automotive testing. The ARCOS data logger family is the most powerful and flexible data logger for fleet testing. The CLIC devices are the newest and fastest data acquisition modules for analogue signals in vehicles.

ARCOS

Type	data logger
Functionalities	CCP/XCP measuring on CAN & Flex Ray
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

ARCOS

Type	data logger
Functionalities	ATFX/mdf 4 data format
ASAM Standards	ASAM ODS, ASAM MDF

µCROS

Type	data logger
Functionalities	CCP/XCP measuring on CAN & Flex Ray
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

µCROS

Type	ata logger
Functionalities	ATFX/mdf 4 data format
ASAM Standards	ASAM ODS, ASAM MDF

Contact: Mr. Stephan Bacher: Mail: bacher@caetec.de

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carts GmbH

carts GmbH is a leading producer of premium test benches, and supports mainly automotive companies with new and further developments of high-valued automation solutions. The scope of products ranges from single test bench through customization of special purpose solutions up to completely virtual lab car, allowing to operate all important ECU in real time. carts' HiLs are in action worldwide and set trends on markets.

Contact: Mr. Andre Bergmann, Mail: Andre.Bergmann@carts.de

Amalie-Wündisch-Straße 4
34131 Kassel, Germany

Phone + 49 561 816198 0
Fax + 49 561 816198 199

www.carts.de

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cbb software GmbH

We are a software company developing software for the automotive, energy and testing branch. We are working for research and development departments of known automobile manufacturers. Furthermore do we develop software products for the power industry and other industries.

Contact: Ms. Beate Behrendt, Mail: beate.behrendt@cbb.de
Offices: DE mailbox@cbb.de (Braunschweig, Ingolstadt, Stuttgart)

Isaac-Newton-Str. 8
23562 Lübeck, Germany

Phone + 49 451 39771 0
Fax + 49 451 39771 29

www.cbb.de

CMORE Automotive GmbH

We are experts in the development of new systems in the field of vehicle electronics as well as the validation of sensor-based driver assistance and safety systems. At our facilities in Lindau (Bodensee) and Boeblingen, (both Germany) our range of services encompasses not only embedded software development, we also execute complex projects for our customers, and manage them throughout the entire product development process, from prototyping and testing to series production. A key focus in the development of the automotive branch is highly-automated an autonomous driving. With our expertise and know-how we thrive to become one of the pioneers of autonomous driving.

Kemptener Str. 99
88131 Lindau (Bodensee), Germany

Phone +49 8382 3049 313

www.cmore-automotive.com

MORE AUTOMOTIVE

PODBOX

Type	Diagnosis ECU
Functionalities	The multifunctional platform for the automated reporting of test drives, as well as a measurement and diagnostic unit. Its compact design combined with its numerous interfaces permits the PODBOX to be used in the laboratory and also in the vehicle. A highlight of the PODBOX is its independence from operating system, as all data are accessible via a web browser.
ASAM Standards	ASAM MCD-2 D (ODX)

Contact: Mr. Gregor Matenaer, Mail: gregor.matenaer@cmore-automotive.com

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Cognitran

Cognitran Ltd.

3 Wheelwrights Yard, Essex
CM3 2EA Hatfield Peverel, Great Britain

Phone + 44 1245 383040
Fax + 44 1245 382189

www.cognitran.com

Offices
PL

Cognitran provide the tools that help companies gain control over complex business activities and provide innovative ways to deliver product-specific and market-specific information to end users via the Internet. Our systems deliver cost efficiencies by re-using data across multiple information types and programs with our advanced linguistic tools minimising translation costs. All solutions are built on non-proprietary and modular XML technology using advanced software and techniques. Existing work has met industry-wide acclaim for the use of pioneering technology and our customer base includes many global manufacturing companies. Through our core products we deliver an end to end solution for OEM publication requirements 1. ISIS – a fully integrated online AfterSales Package, incorporating maintenance and repair documentation, diagnostics and service history. 2. Blaise – a comprehensive document creation and management system which simplifies content re-use and gives you total control over the creation, translation and publishing process.

Contact: Mr. Ben Schneider, Mail: ben.schneider@cognitran.com

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CONTROLTEC
UNLOCKING THE POWER OF DATA

Control-Tec LLC

999 Republic Drive Suite 100
48101 Allen Park, United States

Phone + 1 313 228 0401
Fax + 1 313 982 1305

www.control-tec.com

Established in 2009, Control-Tec is a start-up technology-based company specializing in vehicle data acquisition systems & custom analysis software for the light and heavy-duty transportation industries. Our Vehicle Data Recorders record data in near real-time from the vehicle and upload the data via cellular from all over six continents.

CT-1000

Type	Data Logger
Functionalities	Vehicle Data Acquisition & Telematics
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MDX

Qualifier

Type	Automated Vehicle Validation Service
Functionalities	Data Acquisition & Analysis, Telematics, Cloud
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MDX

Contact: Mr. William Leisenring, Mail: bleisenring@control-tec.com

CPAC Systems AB

CPAC is a system integrator for the vehicle industry. Our business is the development and manufacturing of safety critical control systems for industrial vehicles, marine vessels and trucks. We combine technology and business development in a way that brings greater value to our clients. Our basis is our deep knowledge in developing and integrating safety-critical electronic control systems for every type of commercial vehicle. Our entrepreneurial culture and business mind-set helps us to identify and evolve those features that really make a difference. The end result is often far better than anyone anticipated. In other words, we take control forward.

Contact: Mr. Peter Helgeson, Mail: peter.helgeson@cpacsystems.se

Falkenbergsgatan 3
41285 Göteborg, Sweden

Phone + 46 735 58 32 06

www.cpacsystems.se

Offices
US Chesapeake

CSM GmbH

CSM is an owner-managed independent technology company and a leading supplier for modular measuring equipment and data loggers for automotive industry. CSM is known for very small and rugged, high precision modules, designed for use in extreme environment. Leading OEMs and their suppliers use these products for tests and measurements in vehicles and in test benches worldwide.

INCA AddOn

Type	SW AddOn for ETAS INCA Development Tool
Functionalities	Configuration and handling of CSM MiniModules in INCA
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

MiniModules

Type	Measurement modules for analog data
Functionalities	Acquisition of analog signals and output to CAN or EtherCAT
ASAM Standards	ASAM MCD-1 XCP

UniCAN 2

Type	Failsafe µ-controller based datalogger
Functionalities	CAN bus data acquisition and monitoring, fleet management, J1939
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP

Contact: Mr. Christoph Mühleis; Mail: info@csm.de

Raiffeisenstr. 36
70794 Filderstadt, Germany

Phone +49 711 77964 29
Fax +49 711 77964 40

www.csm.de

Offices
US gsheahen@csm-products.com

D2T

D2T Powertrain Engineering offers a large selection of modular solutions, which are easy to integrate and fully compliant with other equipment and software on the market. It also provides test bed engineering solutions and powertrain engineering services. Its worldwide presence enables D2T to offer the full range of its services and products to all transport sector manufacturers.

Z.A. de Trappes-Elancourt, 11 rue Denis PAPIN
78190 Trappes, France

Phone + 33 1 30130 707
Fax + 33 1 30130 710

www.d2t.com

Offices
DE t.reissner@d2t.de
US jerry.pospiech@d2t.com
KR sw.song@humac-d2t.co.kr
CN liyunlong@d2t.com.cn

MORPHEE

Type	Test bed automation system
Functionalities	One single system covering automation, ECU calibration and real-time simulation on a test cell. Reliable, powerful, open and upgradeable as it is, MORPHEE is a perfect solution for controlling your test cells as safely as can be. Whatever kind of test facility you have, MORPHEE adapts to your working methods and provides you with the latest technology in order to reduce your development time.
ASAM Standards	ASAM ACI, ASAM MCD-3, ASAM ODS

OSIRIS

Type	Combustion analysis system
Functionalities	Real time combustion analysis in a test cell or on-board a vehicle. OSIRIS is a turn-key fast acquisition system. Originally designed to sample data at each engine revolution crank angle, it can also work as a time based oscilloscope. Fast to install and easy to use, it covers all needs of engine engineers during every step of a powertrain development.
ASAM Standards	ASAM MCD-3

TEST MANAGER

Type	Test data management system
Functionalities	This data base solution perfectly fits the collaborative working environment of modern test centers. TEST MANAGER is an essential add-on to MORPHEE for maximum productivity at reduced administration costs. It provides central handling, sharing and protection of the test data of all your co-workers, from the test demands to the result files, including test procedures. It is based on robust, powerful and proven data bases and easily adjusts to customer specific data flow and data models.
ASAM Standards	ASAM ODS

Contact: Mr. Régis De Bonnaventure, Mail: regis.de-bonnaventure@d2t.fr

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DSA - Daten- und Systemtechnik GmbH

Pascalstr. 28
52076 Aachen, Germany

Phone + 49 2408 9492 0
Fax + 49 2408 9492 92

www.dsa.de

Offices
US claus.meyer@dsasystems.com
CN wyy@dsa.com.cn

DSA has a very wide experience in electrical and electronic testing at all stages of the vehicle life cycle. Our expertise lies in systems, hardware and software products for supporting diagnostic processes in engineering, manufacturing and aftersales. DSA delivers and operates its high-quality systems globally. Our customers include the international automotive and automotive supplier industry.

Authoring Guidelines & Process Setup

Type	Consulting & Technical Documentation
Functionalities	Interested in setting up ODX- and/or OTX-based diagnostic processes within your organization? We have all the necessary know-how to define efficient and streamlined processes for all process participants starting with the supply-chain and covering engineering, production, service and the independent after-market. We document your processes, define and specify the necessary authoring guidelines for ODX and OTX and help your tool suppliers to implement process and guidelines into the tools. Please ask for our project references.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3, ASAM MCD-3 D

PRODIS.Authoring

Type	Diagnostic Data and Application Authoring Tool
Functionalities	PRODIS.Authoring is a full-fledged authoring environment to edit, maintain, test and release all your diagnostic data and applications for dealerships and workshops. Its elaborate ODX import functionality and graphical test application authoring capabilities - including OTX support - make it the number one authoring tool for service diagnostics worldwide. Apart from the support of these cutting edge standards, it comprises features for the integration of technical documentation (RMI -Repair & Maintenance Information), wiring diagrams, part locators, repair videos etc. Its module to author and maintain helpful guided diagnostics has received astonishing market attention. With PRODIS.Authoring you provide vehicle platform data releases to be executed in our lean and fast service diagnostic runtime system PRODIS.RTS with one button click. A key feature of PRODIS.Authoring is its elaborate support for variant management in the life-cycle of your vehicle platforms.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3, ASAM GDI

PRODIS.Automation

Type	Authoring tool for engineering and production diagnostic, flash programming and configuration applications
Functionalities	PRODIS.Automation is the most advanced solution for the graphical authoring, maintenance and release of diagnostic, flash programming and configuration applications for your engineering and production purposes. It comprises our renown ODX Browser, which allows for the efficient drag&drop implementation of sequences, also compliant to the new OTX standard. Interfaces for vehicle communication (ASAM MCD-3D) as well as test stand and test equipment integration (ASAMGDI) are integrated into the tool. PRODIS.Automation ships with an integrated version and configuration management solution, ideally supporting team collaboration and traceability of all changes.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3, ASAM MCD-3 D, ASAM GDI

PRODIS.MCD

Type	ASAM MCD-3D Diagnostic Kernel
Functionalities	PRODIS.MCD is our implementation of the ASAM MCD-3D standard. We support versions 2.0.2 and the newest standard version 3.0.0. PRODIS.MCD is recognized as the fastest implementation of the standard in terms of execution time and supports unchallenged parallelism to communicate with many ECUs simultaneously. PRODIS.MCD has the capability to operate on ODX data of all three major released versions (2.0.1, 2.1.0, 2.2.0) of the ODX standard, even if multiple files of different standards are mixed within one project! To ensure safe and fast distribution of the ODX data to testers in the field (pilot, production, service) PRODIS.MCD ships with an intelligent data converter that releases a very compact binary file. With respect to VCI integration, PRODIS.MCD can integrate VCIs compliant to the ISO 22900-2 D-PDU API standard as well as VCIs compliant to the SAE J2534-1 standard. PRODIS.MCD is part of our extensive diagnostic test tool suite PRODIS, but can also be licensed as a separate product for integration into your diagnostic tool chain. By the way - this product is also DoIP-ready!
ASAM Standards	ASAM MCD-3, ASAM MCD-3 D

PRODIS.MVCI (Modular Vehicle Communication Interface)

Type	Diagnostic hardware interface with MCD-3D compliant software interface
Functionalities	Our VCI hardware is always equipped with support for the ISO 22900-2 (D-PDU API) standard. As such our VCIs are an ideal basis for MCD-3D implementations, like our PRODIS.MCD, PRODIS.RTS and PRODIS.WTS. By the way - this product is also DoIP-ready.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3, ASAM MCD-3 D

PRODIS.OET

Type	Engineering test tool to interactively test compliance between an ECU or a set of ECUs and their ODX specification.
Functionalities	With PRODIS.OET you can interactively test your ODX data against an ECU (prototype) or against simulations. The testing of partially integrated vehicle electronics is also supported. All tests and test results are recorded and can be reported in different formats, e.g. for exchange with the ECU developer or for archiving. The automatic repetition of previous tests as well as the monitoring and analysis of all ongoing bus communication are key features of the tool. And if you want to integrate your parameterized ODX services and jobs into test sequences: Just drag them out of OET and drop them in a graphical PRODIS.Automation or PRODIS.Authoring test sequence. Naturally, PRODIS.OET comprises our renown implementation of the ASAM MCD-3D standard PRODIS.MCD.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3, ASAM MCD-3 D

PRODIS.RTS

Type	Diagnostic runtime system for vehicle & machine manufacturing plants
Functionalities	PRODIS.RTS is our benchmark-winning diagnostic runtime system for all manufacturing plants. It supports utmost parallelism in communicating to ECUs and comprises both our renown PRODIS.MCD (implementing ASAM MCD-3D) and a full GDI Stack for communication to test equipment and test stands, like rolls, filling, robots etc. Apart from this standardized functionality PRODIS.RTS is an automation system with full support for digital vehicle data supply, quality data storage, worker guidance etc. PRODIS.MCD is designed for robustness in the field and can be operated multi-shift around the clock
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3, ASAM MCD-3 D, ASAM GDI

PRODIS.Share

Type	Internet Distribution Platform for Diagnostic Data
Functionalities	Consistently and efficiently shipping diagnostic data, including ODX and OTX data, to the field (e.g. to service technicians or dealerships) has become a key challenge. PRODIS.Share solves all your needs for a flexible, secure and highly available internet-based distribution platform. It is capable to serve diagnostic data packages and core software to thousands of dealerships simultaneously through cloud replication services. But, it is also possible to deliver a patch release to only one or a small set of dealerships for tryout. With PRODIS.Share the need for DVDs to distribute service tester updates to the field is history.
ASAM Standards	ASAM MCD-2 D (ODX)

PRODIS.WTS

Type	Diagnostic runtime systems for service uses cases
Functionalities	PRODIS.WTS is our cutting-edge diagnostic and flash runtime system

for all vehicle service purposes. It runs in more than 18.000 installations worldwide in dealerships of 9 machine and vehicle OEMs. Its flexibility in accommodating specific workflows and CI requirements as well as its full support for ASAM standards MCD-3D and ODX, ISO standard 22900-1 and SAE standard J2534 make it a future-ready tool that also supports all known requirements of Euro 5/6 and V/VI legislation, respectively. As such it has been successfully analyzed for compliance by representatives of the European legislation body. As you would expect with any member of the PRODIS family, PRODIS.WTS is very fast and allows for the parallel communication to all ECUs in the vehicle.

Supported ASAM Standards ASAM MCD-3, ASAM MCD-3 D

Contact: Mr. Alfons Schulte, Mail: alfons.schulte@dsa-ac.de

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dSPACE GmbH

dSPACE stands for complete development systems for electronic controls in automotives, aerospace and mechatronics. dSPACE systems are used in R&D applications in industry and universities where fast time-to-market and solid results are key requirements. Typical applications are system and software architecture design, rapid control prototyping, automatic production code generation, hardware-in-the-loop simulation and calibration.

Rathenaustr. 26
33102 Paderborn, Germany

Phone + 49 5251 1638 0
Fax + 49 5251 16198 0

www.dspace.com

Offices
US info@dspaceinc.com
JP info@www.dspace.jp
CN infochina@dspace.com
GB info@dspace.co.uk
FR info@www.dspace.fr

AutomationDesk

Type Automated testing for hardware-in-the-loop (HIL) simulation

Functionalities AutomationDesk is a powerful front-end tool for automated testing of the application software or diagnostic functions of electronic control units (ECUs).

ASAM Standards ASAM MCD-3, ASAM XIL

ControlDesk Next Generation

Type Experiment and instrumentation software for ECU development

Functionalities The software includes functionalities for layouting experiments, instrumentation, measurement, post-processing, ECU calibration, as well as diagnostics access. It offers synchronized data capture across ECUs, RCP and HIL platforms, and bus systems, and has an integrated project and experiment management.

ASAM Standards ASAM CDF, ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MCD-3, ASAM XIL, ASAM COMMON MDF

dSPACE ECU Flash Programming Tool

Type ECU flash programming

Functionalities Software for programming the ECU flash memory via XCP on CAN, XCP on Ethernet, various types of on-chip debug ports like JTAG/NEXUS, NBD/AUD, JTAG/OCDS, DAP and JTAG/ SDI and the dSPACE Generic Serial Interfaces GSI1 and GSI2.

ASAM Standards ASAM MCD-1 XCP

dSPACE Ethernet Configuration Package

Type Hardware-in-the-loop (HIL) simulation

Functionalities Convenient software tool for configuring a dSPACE system as a simula-

dSPACE

	tion node in a Ethernet network. It relies on network data available in a FIBEX representation. It is also used to generate the communication code and controller configuration.
ASAM Standards	ASAM MCD-2 NET (FIBEX)

dSPACE FlexRay Configuration Package

Type	Hardware-in-the-loop (HIL) simulation and rapid control prototyping
Functionalities	Convenient software tool for configuring a dSPACE system as a simulation node in a FlexRay network. It relies on network and scheduling data available in a FIBEX or AUTOSAR representation. It is also used to generate the communication code and controller configuration.
ASAM Standards	ASAM MCD-2 NET (FIBEX)

dSPACE XCP Service

Type	XCP service to be implemented on the ECU
Functionalities	ECU service code for XCP on CAN and Ethernet (TCP/IP, UDP/IP) supporting measurement, calibration, bypassing and ECU flash programming.
ASAM Standards	ASAM MCD-1 XCP

Platform API Package

Type	Package of application programming interfaces (API) for accessing simulation platforms
Functionalities	Program interfaces in .NET and Python for reading, writing, stimulating and capturing model variables on dSPACE real-time platforms.
ASAM Standards	ASAM XIL

RTI Bypass Blockset

Type	Rapid control prototyping (primarily bypassing) and hardware-in-the-loop (HIL) simulation
Functionalities	Simulink® blockset providing ECU read and write access from dSPACE real-time platforms via different kinds of ECU interfaces such as CCP, XCP, DPMEM PODs or on-chip debug ports. The blockset is especially designed for the dialog-based configuration of bypass applications. It allows ASAM MCD-2 MC (ASAP2) files to be imported and ECU variables to be selected via a convenient browser. It handles conversion formulas and the selection of bypass hooks automatically. In addition, the RTI Bypass Blockset supports on-target (internal) bypassing, allowing the bypass model to be compiled and downloaded directly into the free flash memory and RAM of the target ECU. For this, model parameters and signals are automatically added to the ECU's ASAM MCD-2 MC (ASAP2) file.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L)

SystemDesk

Type	System and software architecture development
Functionalities	SystemDesk supports the development of software architectures and distributed automotive electrics/electronics (E/E) systems. Such systems can be modeled according to the AUTOSAR standard. Existing communication matrix files can be imported in SystemDesk to specify network communication. When AUTOSAR software components are modeled or imported in SystemDesk, available ASAM MCD-2 MC (ASAP2) models can be imported as well. During generation of the AUTOSAR run-time environment (RTE) and virtual ECUs (V-ECUs), ASAP2 file generation is also performed for variables that are tagged for calibration and measure-

ment according to the AUTOSAR concept. When V-ECUs are built, instances of the XCP service (XCP on Ethernet – TCP/IP) are implemented in the V-ECU code. Thus, the V-ECUs and variables described in the ASAM MCD-2 MC (ASAP2) files can be accessed during simulation.

ASAM Standards: ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

TargetLink

Type: Production code generation (for ECU development)

Functionalities: TargetLink is a software system that generates production code (C code) straight from the MATLAB®/Simulink®/Stateflow® graphical development environment. The C code generation options range from plain ANSI C code to optimized fixed- or floating-point code for AUTOSAR platforms. Versatile code configuration options ensure that the production code copes with processor constraints. Converting graphical models directly into production code ensures perfect consistency between model and code at all times. Since the same model will always result in the same proven code, TargetLink's code generation is deterministic and thus guarantees the highest software quality. Every step can be tested against the specification via the built-in simulation features.

ASAM Standards: ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L)

Variable Editor

Type: Variable description file editor

Functionalities: Convenient tool for visualizing, editing and creating ECU description files according to the AE MCD-2MC standard.

ASAM Standards: ASAM MCD-2 MC (ASAP2/A2L)

Contact: Mr. Jobst Richert, Mail: asam@dspace.de

Dynamometer Services Group Ltd.

DSG Ltd. is a UK based privately owned company supplying systems for diesel and petrol engine, vehicle, transmission, component development and end of line testing worldwide. Drawing on over 40 years of experience we focus on our customers' requirements to ensure that our solutions are both technically and commercially viable and successful.

DaTAQ Pro

Type: Test Bed Control System Software

Functionalities: Data Acquisition, Test Bed Control

ASAM Standards: ASAM MCD-2 MC (ASAP2/A2L), ASAM ASAP3

Contact: Mr. Gregg Atkins, Mail: Gregg@dsgroup.uk.com

Stock End, Station Road, Bransford
WR6 5JH Worcester, Great Britain

Phone + 44 1886 834860
Fax + 44 1886 834879

www.dsgroup.uk.com

E.S.R. Labs GmbH

St.-Martin-Str. 53
81669 Munich, Germany

Phone + 49 176 137700 77

www.esrlabs.com

E.S.R. Labs is a software startup company focusing mainly on embedded software in the automotive industry. On the supplier side we continued to roll out state of the art software technologies in a number of projects for different OEMs. Part of our portfolio are Autosar-Tools, different SW stacks as well as ODX and Fibex tools.

E.S.R. FIBEX Tools

Type	Product
Functionalities	FIBEX editor, FIBEX library
SAM Standards	ASAM MCD-2 NET (FIBEX)

E.S.R. ODX Tools

Type	Product
Functionalities	ODX editor, ODX library
ASAM Standards	ASAM MCD-2 D (ODX)

Contact: Mr. Wolfgang Köcher, Mail: wolfgang.koecher@esrlabs.com

Eberspaecher Electronics GmbH & Co. KG

Robert-Bosch-Str. 6
73037 Goeppingen, Germany

Phone + 49 7161 9559 237
Fax + 49 7161 9559 455

www.eberspaecher-electronics.com

Eberspaecher Electronics belongs to the pioneers in the field of the automotive bus system FlexRay, which is used in particularly safety critical enviroments. Eberspaecher Electronics develops and manufactures hardware and software platforms for the evaluation of FlexRay in various customer environments. Eberspaecher Electronics is leading in the sales of FlexRay interface platforms and provides a wide range of further FlexRay products for remaining bus simulation, gateways and signal manipulation.

CHI Generator

Type	Export tool to generate CHI (Controller Host Interfaces) files out of FIBEX files
Functionalities	The CHI Generator reads the FIBEX file and supports the CHI export of the communication controllers Bosch E-Ray, FreeScale MFR4200, MFR4300, MFR4310, MPC5567 and Fujitsu MB88121, MB91F465X.
ASAM Standards	ASAM MCD-2 NET (FIBEX)

CHI Generator RBS

Type	Export tool to generate CHI (Controller Host Interfaces) files to stimulate a couple of ECUs described in a FIBEX file
Functionalities	The CHI Generator reads the FIBEX file and supports the CHI export of the communication controllers Bosch E-Ray, FreeScale MFR4200, MFR4300, MFR4310, MPC5567 and Fujitsu MB88121, MB91F465X. The physical ECUs of an RBS (remaining bus simulation) together with a number of ECUs, which are to be simulated, will be defined, and thus a CHI file for an ECU simulating the remaining bus will be exported.
ASAM Standards	ASAM MCD-2 NET (FIBEX)

FlexConfig Developer

Type	Configuration tool for FlexRay networks
Functionalities	FlexConfig Developer is a cost-effective, powerful and user-friendly design

and configuration software for automotive networks. New networks are easily created by using wizards. Existing networks are clearly displayed and can be changed easily. With the help of the numerous export options, almost every hardware platform can be configured with the network data.

ASAM Standards ASAM MCD-2 NET (FIBEX)

FlexConfig RBS

Type Creation of complete hardware based remaining bus simulations (RBS) and gateways for FlexRay / CAN

Functionalities FlexConfig RBS is a configuration software tool consisting of three packages: RBS (remaining bus simulation), gateway and control (signal manipulation). In combination with the FlexXCon midget hardware platform is made available a compact, high-performance, comprehensive solution for applications such as: • ECU development • Rapid prototyping • Function tests • Test benches

ASAM Standards ASAM MCD-2 NET (FIBEX)

Contact: Mr. Christian Huschle, Mail: christian.huschle@eberspaecher.com

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Elektrobit Automotive GmbH

Am Wolfsmantel 46
91058 Erlangen, Germany

Phone + 49 9131 7701 0
Fax + 49 9131 7701 333

www.elektrobit.com

Offices
DE/AT info.automotive@elektrobit.com
JP info-jp@elektrobit.com
US asw.us@elektrobit.com

Elektrobit (EB) establish itself among the key suppliers of embedded automotive software solutions. Apart from the development of future-oriented products, the company also specializes in services and consulting for the automotive industry, supplying serial-software-solution implementations for a broad range of AUTOSAR and FlexRay, Infotainment, Navigation, HMI and Driver Assistance systems.

EB tresos Busmirror

Type Rest Bus Simulation Solution

Functionalities EB tresos Busmirror is able to emulate missing FlexRay nodes in the network (rest bus simulation). This allows developers to test their own ECU software performance in interaction with emulated ECUs and to simulate potential error scenarios. Functions can be processed on the hardware in real-time using target user-modules.

ASAM Standards ASAM MCD-2 NET (FIBEX)

EB tresos Designer

Type Network design tool for AUTOSAR based embedded systems

Functionalities The EB tresos Designer is a versatile system design tool for the generation of CAN and FlexRay network configurations. Powerful wizards support the configuration of the interdependent protocol parameters and immediately highlight parameter constraint violations. Standardized exchange formats like ASAM MCD-2 (FIBEX) enable the further use of the generated communication matrix in other COTS tools and the whole EB tresos product family, e.g. EB tresos Studio or EB tresos Inspector.

ASAM Standards ASAM MCD-2 NET (FIBEX)

EB tresos Inspector

Type Measuring and analysis tool in FlexRay and CAN networks

Functionalities EB tresos Inspector seamlessly integrates both FlexRay and CAN bus

	systems. Measurements are displayed in frame and signal analysis windows. It can be used for gateway and run-time analysis and entails various signal-display instruments such as bar and pointer instruments as well as y-t oscilloscopes.
ASAM Standards	ASAM MCD-2 NET (FIBEX)

EB tresos Studio

Type	Basis Software Configuration for AUTOSAR Modules
Functionalities	EB tresos Studio is a feature-rich configuration environment for basic software components in accordance with AUTOSAR. It allows to configure, validate and generate basic software in an easy-to-use graphical user environment. Through its open interfaces it can be extended with customer-specific software modules. Consequently, legacy parameter descriptions, like BDC, LDF or OIL, can be imported as well, making it the ideal tool for company-wide software deployment.
ASAM Standards	ASAM MCD-2 NET (FIBEX)

Mail: info.automotive@elektrobit.com

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emotive GmbH & Co. KG

Pfingstweideweg 17
73760 Ostfildern-Stuttgart, Germany

Phone +49 711 489089 22
Fax +49 711 489089 10

www.emotive.de

Emotive is an independent expert for automotive diagnostic systems. Based on the diagnostic standards OTX (ISO 13209), ODX (ISO 22901) and the MVCI D-Server (ISO 22900) emotive offers modern and innovative software products for the diagnostic process chain. Emotive supports their customers to implement their diagnostic concepts through consulting, training and custom developments.

Open Test Framework

Type	Software
Functionalities	The EMOTIVE Open Test Framework (OTF) is a complete and native development environment for OTX (ISO 13209). It has been architected for the designing, visualization, maintaining and testing of a new generation of more reliable tester applications. Strictly based on standardized common language and communication mechanisms, the testing Know-how can be exchanged between different departments within the company (Development, Production, Service etc.) and between OEMs and suppliers.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

OTX-API

Type	Software Library
Functionalities	The OTX-API provides client applications with easy, fast and reliable access to OTX data model. The main task is loading of OTX projects and the editing and validating of OTX procedures.
ASAM Standards	ASAM MCD-2 D (ODX)

OTX-Runtime-API

Type	Software Library
Functionalities	The OTX-Runtime-API provides client applications with easy, fast and reliable access to OTX for runtime execution. The main task is loading of OTX projects, browsing the structure and executing of procedures.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

OTX-Viewer

Type	Firefox Addon
Functionalities	The emotive OTX/PTX-Viewer Firefox Addon gives the user the opportunity to view and analyze single OTX files as well as whole OTX projects (PTX) in a very easy and convenient way without a lot of requirements and installation effort. The only requirement is the well-known Mozilla Firefox Browser. The following section describes the installation and usage of the OTX/PTX-Viewer.
ASAM Standards	ASAM MCD-2 D (ODX)

Contact: Mr. Jörg Supke, Mail: Joerg.Supke@emotive.de

Esterel Technologies GmbH

Esterel Technologies is a leading provider of critical systems and software development solutions for the aerospace, defense, rail transportation, nuclear, and industrial & automotive domains. System and software engineers use SCADE® solutions to graphically design, verify, and automatically generate critical systems and software applications with high dependability requirements. Esterel Technologies SCADE product solutions easily integrate, allowing for development optimization and increased communication among team members.

Otto-Hahn-Str. 13 b
85521 Ottobrunn, Germany

Phone + 49 89 608755 64
Fax + 49 89 60875599 99

www.esterel-technologies.com

Offices
FR info@esterel-technologies.com

SCADE Suite

Type	Software development environment
Functionalities	model based software development, certified/qualified
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

Contact: Mr. Tobias Knostmann, Mail: tobias.knostmann@esterel-technologies.com

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ETAS GmbH

ETAS provides innovative solutions for the development of embedded systems for the automotive industry and other sectors of the embedded industry. As a systems provider, ETAS supplies a multifaceted portfolio that covers the range from integrated tools and tool solutions to engineering services, consulting, training, and support. Security solutions in the area of embedded systems are offered by the ETAS subsidiary ESCRYPT. Established in 1994, ETAS GmbH is a 100-percent subsidiary of the Bosch Group, with international locations in 14 countries in Europe, North and South America, and Asia.

Borsigstr. 14
70469 Stuttgart, Germany

Phone +49 711 3423-2240
Fax +49 711 3423-2106

www.etas.com

Offices
US sales.us@etas.com
JP sales.jp@etas.com
FR sales.fr@etas.com
CN sales.cn@etas.com
IN sales.in@etas.com

ETAS ASCET

Type	Measurement, Calibration, and Diagnostics Tool
Functionalities	ETAS ASCMO – Accurate Prediction of Complex System Behavior: ETAS ASCMO facilitates the optimization and calibration of complex systems in virtual environments on the PC. The use of ETAS ASCMO significantly reduces the effort required for testing on real-world systems, e.g., at the test bench or in the vehicle. ETAS ASCMO uses a data-based model of high accuracy to describe system behavior. The model is based on a minimal number of measurements taken on the actual system.
ASAM Standards	ASAM COMMON MDF

ETAS ASCMO

Type	Software development environment
Functionalities	model based software development, certified/qualified
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

ETAS EHANDBOOK

Type	Measurement, Calibration, and Diagnostics Tool
Functionalities	ETAS EHANDBOOK – Interactive ECU Documentation: ETAS EHANDBOOK is an interactive documentation solution for efficient ECU calibration. It offers a large variety of views and chained links for improved ease of navigation through extensive ECU documentation. ASCET and Simulink® are translated into new interactive models to understand the ECU functions and their dependencies in an easy way. This allows calculation and highlighting of signal flows across model hierarchy boundaries, too. ETAS EHANDBOOK links to ETAS INCA to facilitate the live display of values from INCA experiments and to create INCA experiments more quickly. The entire contents (texts, structures, graphics, models) of the ECU documentation is stored in a so-called EHANDBOOK Container. The generation of it based on input data in standard ASAM formats.
ASAM Standards	ASAM CC, ASAM FSX, ASAM MDX

ETAS EHOOKS

Type	Function Development, Software Engineering, Measurement, ECU Calibration, and Diagnostics Tool
Functionalities	ETAS EHOOKS – Bypass Hook Insertion Tool: ETAS EHOOKS is a software tool that facilitates the efficient insertion of bypass hooks into ECU software. The EHOOKS user can place bypass hooks directly into the HEX & A2L files without knowledge of software details – there is no need for access to either ECU source code or ECU software build environment. EHOOKS ECU ports are developed with the support and involvement of the Tier 1 ECU software development team. This allows EHOOKS to do a very high quality job of placing the hooks into the ECU software, but also makes EHOOKS very simple to use.
ASAM Standards	ASAM MBFS, ASAM MCD-2 MC (ASAP2/A2L)

ETAS INCA

Type	Measurement, Calibration, and Diagnostics Tool
Functionalities	ETAS INCA – Integrated Environment for Measurement, ECU Calibration, and Diagnostics: INCA is a universal product family for online and offline calibration of ECU function parameters, controlled via a graphical user interface or remote access. INCA performs the measurement of signals obtained from ECUs and from the vehicle environment, and incorporates powerful tools for managing ECU projects and parameters, analyzing measured and reading diagnostic data, as well as flash programming.
ASAM Standards	ASAM CDF, ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MCD-3 MC, ASAM MDF

ETAS INCA-FLOW

Type	Measurement, Calibration, and Diagnostics Tool
Functionalities	ETAS INCA-FLOW – Guided and Automated Calibration: INCA-FLOW provides a graphical development environment enabling calibration engineers to specify automation sequences for INCA without the need for

programming. To ensure results of consistent quality, INCA-FLOW is fully integrated with INCA and supports best-practice processes for calibration, validation, and measurement.

ASAM Standards: ASAM MCD-2 MC (ASAP2/A2L), ASAM MDF

ETAS INCA-VLINK

Type: Measurement, Calibration, and Diagnostics Tool

Functionalities: ETAS INCA-VLINK – Blockset for Measurement and Calibration on Windows: The ETAS INCA-VLINK Blockset for Measurement and Calibration on Windows allows the calibration and validation of Simulink® models running as executable programs on standard Windows PCs. The Blockset provides a build environment for generating virtual prototypes from Simulink® models with one click. Recorded measurement data can serve as function stimuli. After the generation, executable prototypes can be easily distributed and calibrated with INCA.

ASAM Standards: ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MDF

ETAS INTECRIO

Type: Function Development Tool

Functionalities: ETAS INTECRIO – Integrated Prototyping Environment: INTECRIO Integrated Prototyping Environment supports the development of embedded control software through integrated functions modeled in the engineers familiar ASCET-MD, MATLAB®/Simulink®, AUTOSAR, and/or C code development environment. INTECRIO provides a common environment for prototyping control functions on the PC or in the real world by means of rapid prototyping hardware.

ASAM Standards: ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

ETAS INTECRIO-RLINK

Type: Function Development Tool

Functionalities: TAS INTECRIO-RLINK – Prototyping Blockset: With INTECRIO-RLINK, function developers can perform all steps of prototype configuration and generation directly in Simulink®. The Prototyping Blockset supports configuration tasks for the various ETAS prototyping targets and their connectivity with ECU bypass plus sensor and actuator signals. In addition, the Windows PC is supported for non-realtime prototyping

ASAM Standards: ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

ETAS ISOLAR-A

Type: Software Engineering Tool

Functionalities: ETAS ISOLAR-A – AUTOSAR Authoring: ISOLAR-A is an AUTOSAR authoring tool. It is built on Eclipse technology and uses the Artop framework to enable easy integration into existing development environments. ISOLAR-A can be integrated with other AUTOSAR-compliant tools from ETAS or third-party vendors.

ASAM Standards: ASAM MCD-2 NET (FIBEX)

ETAS ISOLAR-EVE

Type: Software Engineering Tool

Functionalities: ETAS ISOLAR-EVE – AUTOSAR Software Validation: ISOLAR-EVE is an Eclipse-based environment for the configuration of virtual ECUs. ISOLAR-EVE is closely integrated with the ETAS ISOLAR-A AUTOSAR authoring tool and the application software behavior modeling/auto-coding tool

	ETAS ASCET. ISOLAR-EVE is open to other AUTOSAR-compliant authoring and behavior-modeling tools as well as to manually coded AUTOSAR application software components.
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L)

ETAS LABCAR-AUTOMATION

Type	Test and Validation Tool
Functionalities	ETAS LABCAR-AUTOMATION – Automated ECUTesting: Develops, manages, and executes abstract and test bench-independent automated tests for embedded software. To ensure high-quality automated tests, the tool supports different activities and roles in the testing process.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM XIL

ETAS LABCAR-OPERATOR

Type	Test and Validation Tool
Functionalities	ETAS LABCAR-OPERATOR – ECU Test Configuration and Operation: Configures and operates Hardware-in-the-Loop testing systems for the validation and verification of automotive embedded software. LABCAR-OPERATOR provides virtual instrumentation, data and signal flow management, signal generation, and real-time data logging.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L), ASAM XIL

ETAS XETK/ETK

Type	ECU Interface
Functionalities	ETAS XETK/ETK – Universal ECU Interfaces: XETKs/ETKs comprise parallel or serial Electronic Control Unit (ECU) interfaces for calibrating, flashing, measuring, rapid prototyping (bypass), and debugging. XETKs/ETKs are designed to support function development for, and calibration of, automotive ECUs in harsh environments (operating temperature ranges from -40 °C to +110 °C), XETKs/ETKs provide excellent power-on (cold start) features, proven reliability, high performance, low latency, and high data throughput. XETKs support the ASAM XCP standard.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

Contact: Ms. Anja Krahl, Mail: anja.krahl@etas.com

FEV Automatisierungssysteme GmbH

Brehnaer Str. 3
06188 Landsberg / Saalekreis, Germany

Phone +49 241-5689-9140
Fax +49 241-5689-7-9140

Founded in 1978, FEV is an internationally recognized leader in the design and development of internal combustion engines and supplier of advanced test and instrumentation systems. In 2011, the FEV Automatisierungssysteme GmbH has been established to combine the company-wide expertise in automation systems. This newly established subsidiary can look back on many years of experience in the proper and efficient operation of engine test cells. This enhances FEV's position as a highly competent and experienced provider of advanced test cell solutions. We only offer test cell equipment to our customers that has already met the arduous operational demands presented by our own powertrain test facilities and engineering staff.

TestCellManager TCM

Type	Test Bed Automation System
Functionalities	Engine Driveline and component test beds automation a. data acquisition
ASAM Standards	ASAM ACI

Contact: Ms. Kathrin Hilbich, Mail: hilbich@fev.com

GIGATRONIK Ingolstadt GmbH

GIGATRONIK is a development partner specialized in the field of automotive electronics and information technology. We develop solutions in the field of System Architecture & Electrical Systems, Component Development, System Integration & Testing, Vehicle Integration, Process & Project Management, Diagnostics, Data Management, Environmental Systems and Rapid Application Prototyping.

Am Augraben 19
85080 Gaimersheim, Germany

Phone + 49 8458 34880 0
Fax + 49 8458 34880 99

www.gigatronik.com

Offices
DE/AT info-ing@gigatronik.com

MDM Based Systems

Type	www.mdm-community.org
Functionalities	Data management
ASAM Standards	ASAM ODS

Contact: Mr. Walter Gold, Mail: walter.gold@gigatronik.com

HBM United Kingdom Limited (HBM-nCode)

nCode products are provided by HBM, a world-wide technology and market leader, offering products and services across the entire measurement spectrum, from virtual to physical. For over 30 years, nCode has been the leading brand for durability and data analysis solutions. Its technologies help customers understand product performance, accelerate product development, and improve design. The power and ease of nCode technologies are a direct result of its world-class development process and in-depth experience in a broad range of industries. nCode product development is ISO9001 certified. HBM-nCode has a global team of regional sales and application engineers that are available through offices in Europe, North America and Asia.

Technology Centre Adv. Manufact. Park
S60 5WG Rotherham, Great Britain

Phone + 44 845 620 6060
Fax + 44 114 254 1245

www.ncode.com

Offices
GB info@hbmncode.com
US info@hbmncode.com
FR info.fr@hbmncode.com
DE info.de@hbmncode.com

nCode GlyphWorks

Type	Analysis Software
Functionalities	A graphical, process-oriented environment that contains a wide range of data processing and visualization capabilities with specialized options for durability such as fatigue analysis, accelerated testing, and frequency domain tool such as ride quality and rotating machinery analysis. The ASAM ODS connectivity capability in GlyphWorks enables users to browse, search and select data from ASAM ODS database.
ASAM Standards	ASAM ODS, ASAM MDF

Contact: Mr. Kevin Miller, Mail: info@hbmncode.com

HEAD acoustics GmbH

HEAD acoustics is a worldwide leading supplier of products and consulting services for sound and vibration analyses. With the technical reproduction of human hearing we set international standards, moreover we pursue a holistic approach which includes all aspects of human perception of sound and vibration occurrences.

Ebertstr. 30 a
52134 Herzogenrath, Germany

Phone + 49 2407 577 0
Fax + 49 2407 577 99

www.head-acoustics.de

Offices
US info@headacoustics.com
FR HEADFrance@head-acoustics.de
JP

ArtemiS SUITE

Type	Software
Functionalities	Sound & Vibration Acquisition & Analysis The ArtemiS SUITE provides you with an integrated system solution for sound and vibration analysis. The software is also optimally suited for troubleshooting and sound engineering in the noise and vibration area. You can use the ArtemiS SUITE for sound optimization and sound design for technical products, the evaluation of environmental noise and many other purposes. The software combines tools for sound and vibration analysis, structured data management and reporting that are embedded in a straightforward, easy-to-use interface. Enjoy the modern look and feel and the sophisticated concept!
ASAM Standards	ASAM ODS

Contact: Mr. Christian Krohn, Mail: sales@head-acoustics.de

HGL Dynamics Ltd.

Hamilton Barr House, Bridge Mews
GU7 1HZ Godalming, Great Britain

Phone + 44 1483 415 177
Fax + 44 1483 415 237

www.hgl-dynamics.com

Offices
US info@hgl-dynamics.com
FR info@hgl-dynamics.com

HGL markets a wide range of innovative digital acquisition, storage and analysis products, ranging from hand-held to full rack-based test cell systems. Customer benefits include: large channel counts, higher bandwidths, shorter tests and reduced costs. HGL also provides professional consultancy services for vibration analysis, software development and test measurement support.

Contact: Mr. Andrew Law, Mail: alaw@hgl-dynamics.com

HighQSoft GmbH

Schloßborner Weg 6b
61479 Glashütten, Germany

Phone +49 6174 6199905

www.highqsoft.com

HighQSoft GmbH is a worldwide leading and independent supplier of ASAMODS based Product Verification & Validation Management (PVM) business enterprise architecture solutions. This includes the specification, design and implementation of verification & validation data infrastructure solutions in order to manage all kinds of physical data derived during the process of product development. The expertise of our company is to provide solutions that integrate time-, frequency- and event-based engineering verification & validation data from any source - physical or virtual - measured, calculated or simulated - into a well-defined, standardized ASAM ODS database. Furthermore and next to the data import and storage, our business enterprise architecture solutions – which reach from a single test stand to an enterprise – warrant the overall accessibility of the data and various exchange options with different systems and environments. Embedding Legacy Applications such as Archiving, Data Analysis, Reporting – as well as open third-party interfaces - seamlessly integrate the provided solution into given data management infrastructures of the client`s organization. HighQSoft GmbH is a supporter and active member of the openMDM community.

Avalon ODS Server Suite

Type	ASAM ODS 5.3.0 compliant server application
Functionalities	Our Avalon ODS Server Suite is the reference server implementation of the ASAM ODS Standard and is backbone to the majority of ODS 5.3 compliant data storage solutions for OEMs and suppliers within the worldwide automotive industries. The server is fully compatible with all ASAM ODS features and Application Models and holds the flexibility to

store and manage measurement data of any technical domain (e.g. Noise-Vibration-Harshness, Road-Load, Engine, Wind-Tunnel, Crash, Brakes, ...), integrates several Measurement Data Format Files (e.g. MDF4.1, MDF3.x) and provides inter-exchangeability with the ASAM Transport Format file (ATFx). The generic and platform independent implementation of the standalone Java server application provides highest standards in performance, session multithreading and memory management for Windows and Linux 64-bit distributions.

ASAM Standards: ASAM ODS, ASAM MDF

Basic Web Server

Type: ODS Web server for convenient web access to measurement data and implementation of specific work-flows-/use-cases.

Functionalities: Our Basic Web Server is an application for convenient ODS data access via web. The application provides generic data management functionality to dynamically navigate through, search, identify as well as export / post-process measurement data. It offers a basic but customer specific approach to search, identify and then manage or forward / process required measurement data without greater efforts nor stressing hardware infrastructure or bandwidth. Key features of the application are:

- ODS data navigation
  - data navigator with configurable navigation trees
  - presentation of instance meta-information and dependencies, tabular and graphical channel quick view
  - presentation of AoFile dependencies
- data search - with multiple and configurable search patterns and
- data favorites and cart
- user/application
- data export options (ATF, CSV)
- Tool interfaces (e.g. DIAdem)

The PVMsys ODS Basic application relies on the requirements of the ASAM ODS base model only. The basic application is therefore ready to use independently to the application model used. The application is based on our Integration Platform and therefore allows further development / adaption to specific use-cases.

ASAM Standards: ASAM ODS, ASAM MDF

Consulting

Type: It's a service

Functionalities: The consulting is based on the company's expertise on business enterprise architecture solutions for verification & validation data management. The consulting usually addresses e.g. the specification of architecture and setup for new solutions, the specification, design and implementation of import tools but also is available for identification of other ODS issues and finding their solution.

ASAM Standards: ASAM ODS

Merlin Analysis Server

Type: Analysis Server for integration of automated analysis (DIAdem, JAVA, ...) into your ODS solution

Functionalities: Merlin is a CORBA server application for evaluation and analysis in an ASAM ODS environment. It is a service component based application

with an underlying OSGi technology. The list of available evaluation components can be dynamically extended by any application that follows the administration service interface. A ready to use administration tool application is available. An evaluation is defined to return a result, which normally is a report, an image or just a status. The evaluations can be run automatically in a background execution, e.g. after import or periodically, or can be used from other application that needs to have a growing list of evaluations. Well known use-cases for Merlin are verification of mass data and assign attribute content depending on result, calculation of new channels, creating of report and export files or archiving parts of data storage. The development of an evaluation is easy and is supported by abstract classes.

ASAM Standards: ASAM ODS, ASAM MDF

Contact: Mr. Ralf Noerenberg, Mail: ralf.noerenberg@highqsoft.de

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HORIBA GmbH

Landwehrstr. 55
64293 Darmstadt, Germany

Phone + 49 7158-933-491
Fax + 49 7158-933-691

www.horiba.com

Offices
JP info@horiba.co.jp
DE sales.hade@eu.horiba.com
GB marketing.uk@horiba.com
US news-ats.us@horiba.com
CN sales.hst@cn.horiba.com

HORIBA Automotive Test Systems Part of the HORIBA Group has developed global leadership in the exhaust gas analysis, powertrain research and development and various certification test system fields. HORIBA is able to provide total solutions to its customers, with full turnkey capability for driveline, engine, powertrain and vehicle tests. HORIBA serves manufacturers and suppliers in every industry that utilizes internal combustion, turbine engines, including automotive, heavy-duty/off road, lawn and garden, marine, aerospace, locomotive and recreational and utility vehicles.

DIVA: – Data – Interpretation – Visualization – Analysis

Type: Software for Graphical Evaluation and Analysis of Post-Test Data
Functionalities: Chassis, Engine, Driveline, Powertrain, Brake, Emission Testing, Post-Processing, Reporting
ASAM Standards: ASAM ODS

STARS

Type: Automation System
Functionalities: Engine, Driveline, Vehicle and Brake Test Bed Automation; Component Test Bed Automation; Distributed Operation; Automatic Engine ECU Calibration; Small, Light Duty and Heavy Duty Engine Emission Test Application Suite; Web Based Remote Status Monitoring; Integrated Automatic Engine ECU Calibration Option
ASAM Standards: ASAM MCD-3 MC, ASAM ASAP3, ASAM ACI, ASAM ODS

VETS ONE: Vehicle Emission Test System

Type: Automation Software for Vehicle Emission Testing
Functionalities: Chassis, Automation System for Chassis Dyno, Vehicle Emission Testing, Laboratory Management
ASAM Standards: ASAM MCD-3 MC, ASAM CEA, ASAM ODS

Contact: Mr. Volker Werner, Mail: volker.werner@horiba.com

iASYS Technologies Pvt. Ltd.

Flat #5, Tupe Residency, 11, Thube Park
near Sancheti Hospital, Shivaji Nagar
411005 Pune, India

Phone + 91 20 255 20602
Fax + 91 20 255 34381

www.iasys.co.in

IASYS is an independent system integration company that provides test automation and data management solutions based on ASAM standards. IASYS provides automation solutions for Engine Test Bed / Brake Test Bed / Vehicle chassis dynamometer / Transmission Test.

Orbit e

Type	Engine Testing Automation System
ASAM Standards	ASAM ACI, ASAM MCD-3, ASAM ODS

Orbit Enterprise

Type	Test data management system for Emission / Component
Functionalities	Orbit Enterprise system allows the user to management test data from different systems into central repository which is based on ODS standard.
ASAM Standards	ASAM ODS

Orbit x

Type	Emission Host System for Vehicle / Engine testing
Functionalities	An emission host system allows to complete automatic execution of legislative emission testing on chassis dynamometer / engine dynamometer.
ASAM Standards	ASAM ODS

Contact: Mr. Puran Parekh, Mail: iasys@vsnl.com

ICS AG - Informatik Consulting Systems AG

Sonnenbergstr. 13
70184 Stuttgart, Germany

Phone + 49 711 21037 624
Fax + 49 711 21037 53

www.ics-ag.de

ICS is a partner for the complete product lifecycle - from evaluation and consulting to realisation and maintenance. The domains are Automotive, Transportation and Aerospace & Defence (e.g. Embedded Control Systems, RAMS, Verification & Test, Quality Assurance). Our wide diversification helps us to understand the problems of our customers. A competent knowledge of technologies, methods and standards enables us to transfer this knowledge into applicable solutions.

Consulting

Type	Consulting, engineering
Functionalities	Consulting in regards to organization and standardization of measurement data storage
ASAM Standards	ASAM ODS

Data Modelling

Type	Consulting, engineering
Functionalities	Design of application models based on the ASAM ODS Standard
ASAM Standards	ASAM ODS

Tool Development

Type	Consulting, engineering
Functionalities	Development of individual applications for user-friendly access to ASAM ODS / ATFX based data. Converter to ATFX.
ASAM Standards	ASAM ODS

Contact: Mr. Thomas Reiner, Mail: thomas.reiner@ics-ag.de

Voltastr. 5
13355 Berlin, Germany

Phone + 49 30 46 70900
Fax + 49 30 46 31576

www.imc-berlin.de

Offices
CN
US

imc Meßsysteme GmbH

imc specializes in development distribution and system integration of products for technical/ scientific applications. imc offers hardware and software products for measuring technology based on different ASAM standards and other technical or scientific applications. For all of its products, imc provides competent technical support and services.

imc CRONOS PL

Type	Universal data acquisition system

Contact: Mr. Ralf Winkelmann, Mail: Ralf.Winkelmann@imc-berlin.de

The Annexe, 81 Horslow Street, Potton
SG19 2NX Sandy, Great Britain

Phone + 44 17 67 26 29 22
Fax + 44 56 03 13 05 03

www.influxtechnology.com

Offices
BG snikolov@influxtechnology.com

Influx Technology Ltd.

Influx Technology make specialist tools for the development of automotive control systems. Vehicle (MCD) data loggers, (OBD) diagnostic and specialist (CDM) tools for development engineers. Formed in 1999 we operate in the UK and Bulgaria with distributors in the US, China, India and Japan.

Contact: Mr. Steve Ratheram, Mail: sratheram@influxtechnology.com

2, place Jules Gévlot
92130 Issy les Moulineaux, France

Phone + 33 1 41 90 08 49

ww.intempora.com

INTEMPORA

Intempora develops the RTMaps software and other related tools for real-time multimodal applications. RTMaps is widely used in the automotive and mobile robotics domains, either for facilitating the development, tests and validation of perception functions based on multiple sensors (vision, data fusion, localization…) or for HMI developments and human factors analysis.

Dataloggers

Type	Wide range of data loggers from small ARM-based architecture devices to clusters of distributed high-performance PCs
Functionalities	Timestamped recording of heterogeneous data streams (compressed & uncompressed videos, GPS, lidars, radars, CAN, IMUs, etc.)
ASAM Standards	ASAM AE MCD-1 XCP, ASAM AE MCD-2 MC (ASAP2/A2L)

RTMaps

Type	Software development environment
Functionalities	Multiple & heterogeneous sensors acquisition Data Timestamping, Graphical development, C/C++ SDK, Record / Playback, Multithread, Embedded deployment, Interoperability with many complementary tools (Matlab, Simulink, simulators…)
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L)

Contact: Mr. Nicolas Du Lac, Mail: nicolas.dulac@intempora.com

Intrepid Control Systems, Inc.

31601 Research Park Drive
48071 Madison Heights, USA

Phone + 1 586 731 7950
Fax + 1 586 731 2274

www.intrepidcs.com

Offices
US moreinfo@intrepidcs.com
DE sbohner@intrepidcs.com
JP icsjapan@intrepidcs.com
CN icschina@intrepidcs.com
IN sbhagwat@intrepidcs.com

Intrepid Control Systems is a global provider of innovative tools to engineers in vehicle, test, and embedded engineering. With thousands of customers worldwide, Intrepid provides embedded communication interfaces for protocols such as CAN, LIN, FlexRay, J1850, Keyword 2000, UART, J1939, ISO14229 and GMLAN. Major customers include automotive and commercial vehicle OEMs from a wide variety of countries. Along with a global network of distributors, Intrepid has offices in the USA, China, Japan, Germany, India, and Australia for direct sales and support.

neoVI FIRE / neoVI RED

Type	Vehicle Interface Adaptor, PC to Vehicle Network Adaptor
Functionalities	Monitor vehicle network, Log vehicle network data, Run real-time scripts, Simulate networks, ECUs, & gateways. Use a stand-alone data logger by logging data to removable SD card. Use for ECU prototyping.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MDX

neoVI PLASMA

Type	Remote Data Logging Tool, Vehicle Fleet Management Tool
Functionalities	Standalone data logger ; Remote data logger with auto-download via WIFI, 3G or Ethernet ; Heads-up display for test vehicles; In-vehicle data acquisition system; Captive test fleet data collection; Fleet management and more. Support for CAN, LIN, FlexRay, MOST, XCP/ CCP, Ethernet, ISO14229, GMLAN, J1939, Analog Inputs, and more.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MDX

ValueCAN

Type	PC to CAN (Controller Area Network) Adaptor/Interface
Functionalities	Dual Channel Isolated Dual Wire CAN to USB interface; Connect PC to a Controller Area Network (CAN) bus
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MDX

Vehicle Spy Professional

Type	Software
Functionalities	Software for performing diagnostics, node/ECU simulation, data acquisition, automated testing, memory edit or calibration, and vehicle network bus monitoring, and more. Supports CAN, LIN FlexRay, MOST, J1939, J1850, K-Line, ISO9141, J1708, ISO14229, UART, Keyword, GMLAN, CCP/ XCP, and more.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MDX

Contact: Mr. Colt Correa, Mail: ccorrea@intrepidcs.com

Im Rollfeld 28
76532 Baden-Baden, Germany

Phone + 49 7221 9922 0
Fax + 49 7221 9922 100

www.ipetronik.com

Offices
DE info@ipetronik.com
US america@ipetronik.com
SE sweden@ipetronik.com
IN india@ipetronik.com

IPETRONIK GmbH & Co. KG

Operating via its four interrelated divisions: IPEmeasure measurement technology; IPEmotion software; IPEengineering Technical Center; and IPEtec Test Bench Technology, IPETRONIK is uniquely positioned to offer one of the industry's only true customer-specific turnkey data acquisition solutions. Having begun as a hardware-only provider nearly two decades ago, IPETRONIK has now developed into an internationally renowned technology partner to some of the world's most prominent vehicle manufacturers, offering a combination of measurement technologies, software, accessories, and unique in-house testing capabilities and facilities. Consistent with the company mission of PROGRESS IS THE FUTURE, 180 highly trained IPETRONIK staff members and sales partners, headquartered in Baden-Baden, Germany; with additional offices in the United States and India, as well as subsidiaries worldwide, ensure constant growth and innovation in response to market needs. We look forward to providing customers with innovations and improved solutions far into the future.

IPEmotion

Type	DAQ Software
Functionalities	Windows DAQ-Software for configuration, acquisition, visualization, analysis, automation, and control applications.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MDF

M-LOG

Type	Hardware for data acquisition and bus measurement
Functionalities	Acquisition, online calculation and storage
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM GDI, ASAM ODS

M-Series Modules

Type	Measurement modules for analog data acquisition
Functionalities	Acquisition of analog signals, A/D conversion and output to CAN
ASAM Standards	ASAM GDI

Mx-SENS, Sx-STG

Type	Measurement modules for fast analog data acquisition
Functionalities	Acquisition of analog signals, A/D conversion and output to Ethernet
ASAM Standards	ASAM MCD-1 XCP

Contact: Mr. Joerg Strothmann, Mail: joerg.strothmann@ipetronik.com

Bannwaldallee 60
76185 Karlsruhe, Germany

Phone + 49 72 19 85 20 39
Fax + 49 72 19 85 20 99

www.ipg.de

Offices
JP
DE

IPG Automotive GmbH

IPG Automotive GmbH is a worldwide leading provider of simulation solutions, test systems and engineering services for OEMs and suppliers in the automotive industry. IPG supports its customers in mastering the technological challenges relating to safety, comfort, agility and fuel economy/energy consumption – with forward-thinking solutions for the entire development process. In addition to conventional vehicle dynamics simulation, the CarMaker, TruckMaker and MotorcycleMaker simulation tools open up a wide range of Model-, Software- and Hardware-in-the-Loop simulation. It encompasses the development and testing of chassis control systems, driver assistance systems as well as systems combining chassis, powertrain and steering. Also included are holistic fuel economy/energy consumption analyses, hybrid technology and electric mobility.

CarMaker

Type	Open integration and test platform for virtual test driving. Applications: General Vehicle Dynamics, Control Systems, Advanced Driver Assistance Systems, Fuel Consumption & Emissions
Functionalities	Flexible model integration from multi-domain environments, maneuver- and event-based testing through „CarMaker Operation System“, easy reconstruction of complex real test driving tasks, efficient system validation in the whole vehicle environment, integrated application in all development phases „X-in-the-Loop“, automated test of comprehensive maneuver catalogs and vehicle variants, powerful interface structure for third party tools
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 NET (FIBEX), ASAM MDF

MotorcycleMaker

Type	Open integration and test platform for virtual test driving. Applications: General Vehicle Dynamics, Control Systems, Advanced Driver Assistance Systems, Fuel Consumption & Emissions
Functionalities	Supporting of different front and back wheel carriers like telescopic fork, telelever, upside-down swing arm and paralever, different drive concepts based on driveshaft, on chain or on swing arm mounted engine, the bending and the torsional stiffness of the body frame and the wheel carriers is taking into account, influence of the driving stability with aerodynamic effects, driving behavior analysis on downhill and uphill slopes and banking on three-dimensional tracks
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 NET (FIBEX), ASAM MDF

TruckMaker

Type	Many axles - much more variants - all in real-time. Applications: General Vehicle Dynamics, Control Systems, Advanced Driver Assistance Systems, Fuel Consumption & Emissions
Functionalities	Real-time performance with every truck/trailer configuration, up to 10 axles with configurable single or twin tires, all special suspension types for trucks and trailers, various powertrain versions up to 8x8, all typical trailer hitch systems (ball, trapezoid, fifth wheel etc.), flexible truck and trailer body, fixed or movable loads and suspended cabin, pneumatic tool box for active brake and air suspension systems
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 NET (FIBEX), ASAM MDF

Contact: Ms. Katharina Brömel, Mail: katharina.broemel@ipg.de

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ISTEC GmbH

Custom software solutions for measurement and testing data management, manufacturing execution systems (MES), for distributing and finance and IT-solutions in heterogeneous system environments.

Development of ODS application models

Type	ODS engineering and ODS consulting
ASAM Standards	ASAM ODS

Nobelstr. 12
76275 Ettlingen, Germany

Phone + 49 7243 7005 00
Fax + 49 7243 7005 199

www.istec.de

Offices
DE ettlingen@istec.de
DE stuttgart@istec.de

Development of ODS-based data management systems (.NET, JAVA)

Type	ODS engineering and software development, system integration, measurement data integration platform (ISTEC-MIP), measurement data search engine (ISTEC-MEDAS)
Functionalities	Order management, data integration, navigation and queries, reporting and analysis
ASAM Standards	ASAM ODS

Operation support

Type	Support ODS-based systems
Functionalities	1st and 2nd level support, incident management, problem analysis and solution
ASAM Standards	ASAM ODS

Software development based on MCD-3D and MCD-2D (ODX)

Type	Software Engineering and Software Development
Functionalities	Building test cases for programming systems testing ECU
ASAM Standards	ASAM MCD-3

Contact: Mr. Michael Meyer, Mail: michael.meyer@istec.de or asam@istec.de

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IXXAT Automation GmbH

Leibnizstr. 15
88250 Weingarten, Germany

Phone + 49 751 56146 166
Fax + 49 751 56146 29

www.ixxat.de

Offices
US sales@ixxat.com
FR info@ixxat.fr

IXXAT is a supplier of data communication solutions for the automotive and the industrial market. IXXAT employs a staff of 80 people and has an ISO 9001 certified quality management. Our core technologies are FlexRay, CAN, LIN, Real-Time Ethernet, IEEE1588 as well as safety relevant solutions (IEC61508). Beside hardware components, the product range includes solutions for test stands, hardware-in-the-loop, vehicle communication test-/analyzing tools, OEM components and protocol software.

EtherCat extension

Type	EtherCat extension of the FRC-EP190
Functionalities	A solution to interface the industrial communication world in test-stands with the automotive communication world in vehicles. By means of the gateway solutions, signals can be mapped between the vehicle and EtherCAT.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

FRC-EP190

Type	Automotive communication platform
Functionalities	Powerful automotive communication platform for FlexRay, CAN, LIN, Ethernet and EtherCAT which can be used in many different applications.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX

Gateway

Type	Gateway solution for FlexRay, CAN, LIN, Ethernet or FDX
Functionalities	Universal gateway solution which can be used standalone or on-top of an RBS. It can be used to create signal based mappings from and to several communication busses or protocols like FlexRay, CAN, LIN,

	Ethernet or FDX. The mappings are done by means of a Windows Explorer like drag&drop tool.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

Residual Bus Simulation

Type	Residual Bus Simulation software package for the FRC-EP190 hardware platform
Functionalities	Residual Bus Simulation, a tool to generate a simulation of a single or several ECU's. The RBS is created without coding effort and can be downloaded to the automotive communication platform for autonomous execution.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

Contact: Mr. Thomas Waggershauser, Mail: waggershauser@ixxat.de

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Keisokugiken Corporation

Keisokugiken Corporation (KGC) has been established in 1980. We specialize in development distribution and customizing system integration of products for automotive measurement and test automation solution based on LabVIEW. We also have experience in engine control data acquisition solutions with combustion analysis system. We also research technology in hardware- in- the-loop- simulation for hybrid and new energy vehicle.

Connecting to ECU calibration tool via ASAP3

Type	Using ECU calibration tool f. Hardware in the loop system of transmission.
Functionalities	ECU data measurement and calibration.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L), ASAM ASAP3

Contact: Mr. Noriyuki Hirose, Mail: hirose@kgc.co.jp

Kistler Instrumente AG

Kistler is a strong partner of the automotive industries for measurements of force, torque, pressure and acceleration. A worldwide organization with 1200 employees and 25 group companies supplies the automotive industries with sophisticated high-end system solutions. Instrumented crash test facilities, e.g. crash barriers and crash trolleys with piezo-technology as well as wheel force measuring systems with piezo- and strain gauges technology for almost every application are core competencies in the field of automotive engineering.

Contact: Mr. Mirko Ciecinski, Mail: mirko.ciecinski@kistler.com

2021-5 Housyakuji, Takanezawa,
Shioyagun
329-1233 TOCHIGI, Japan

Phone +81 28 680 1611
Fax +81 28 680 1610

www.kgc.co.jp/index-en.html

Eulachstrasse 22, Postfach
8408 Winterthur, Switzerland

Phone + 41 52 224 11 11
Fax + 41 52 224 14 14

www.kistler.com

Offices
DE info.de@kistler.com
US sales.us@kistler.com
IT sales.it@kistler.com
SG sales.sg@kistler.com
SE info.se@kistler.com

Adams-Lehmann-Str. 109
80797 München, Germany

Phone +49 89 3229966 0
Fax +49 89 3229966 999

www.kpit.com

KPIT Technologies GmbH

KPIT is expert for diagnostics and telematics in the automotive industry. Innovative products and a broad range of consulting and engineering services meet the tough demands on flexibility and professionalism. Therefore, since 1999, leading vehicle manufacturers and suppliers rely on our powerful and high-quality software and hardware-solutions. With In2Soft Diagnostic Tools and K-DCP Diagnostic Authoring and Framework solutions KPIT provides a complete tool set for vehicle diagnostics. (KPIT Diagnostic and Connectivity Platform). KPIT, is a fast growing global product engineering and IT consulting partner focused on co-innovating domain intensive technology solutions for automotive & transportation, manufacturing and energy & utilities corporations. KPIT is at the forefront of automotive engineering with solutions in the areas of AUTOSAR & In-Vehicle Networks, Body Electronics, Chassis, Safety & Driver Assistance, Functional Safety, Vehicle Diagnostics, Telematics, Infotainment and Powertrain. Established in 1990, KPIT has its head office in Pune/India and operates globally through 31 offices and 7 development center across America, Europe and Asia.

In2Soft Diagnostic Tools DatabaseDesigner

Type	ODX Editor incl. Checker, Differ, Formatter & Inspector
Functionalities	Creates and administers ODX data in conformance with the international industry standards ODX 2.0.1 and ODX 2.2.0. Provides options for creating a completely new data structure or selectively adapting the existing data in the desired format (OEM and Tier1 collaboration). Compatible to work with all dialects of the ODX standards. Provides an option to create the right data for UDS control unit with in-built UDS on CAN description of KPIT. Object-based comparison of whole ODX projects or selected layers, resolved inheritance, expert and diagnostic modes, XML/PDF report. Complete project or single layer formatting, output formats: PDF, MSR, DOC/RTF (on demand). XML validation, ASAM rule set check, API for company-specific rules, configurable error descriptions and correction instructions, XML/XLS and PDF export.
ASAM Standards	ASAM MCD-2 D (ODX)

K-DCP Diagnostic Authoring

Type	OTX Editor, Executer and Debugger, UI and Navigation Edit or Multi-User Workflow and Publication management
Functionalities	Graphical visualization and drag ‘n drop of OTX elements. ODX support with Diagnostic Wizard and Diagnostic View incl. auto-generation of sequences to access i.e. measurement-values, identification data or adjustment values. Validation and debugging of sequences on simulation channel or VCI hardware. UI-Editor to create custom specific screens. Navigation editor used to control the workflow in the K-DCP Diagnostic Framework. Data and workflow management for multi-users with different roles. Publication management with K-DCP License & Update Management system. Sequence code generation.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

K-DCP Diagnostic Communicator

Type	Generic Diagnostic Tester for ECU / Vehicle validation
Functionalities	Execution of ODX diagnostic services and OTX sequences. Bus monitoring (CAN / K-Line) with timestamps, filtering and symbolic (CANdb-/ODX-based) offline analysis of bus traces. Simulation channel. Supported hardware: I2S-eCOM (KPIT Interface), DoIP, Vector CANcardX-XL/CANcase, dSpace DCI-CAN/Calibration Hub, others on request.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

K-DCP Diagnostic Framework

Type	Platform to create customer specific solutions for Engineering / Production and Aftersales Use-Cases
Functionalities	Data driven platform for Engineering, End-of-Line and Aftersales solutions based on ODX and OTX that can be used stand-alone, on cloud servers or telematics hardware and can be extended with customer specific use-cases created with the K-DCP Diagnostic Authoring tool. Supported hardware: I2S-eCOM (In2Soft Interface), DoIP, Vector CANcardX-XL/ CANcase, dSpace DCI-CAN/Calibration Hub, others on request.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

ODX / OTX / MCD-3 D Expert Services

Type	Training, Consultancy and Engineering
Functionalities	Trainings, Support and Consultancy for ASAM MCD-2 D and 3 D, as well as Engineering Services, e.g. ODX Converter, MCD-3 D Kernel integration and implementation of diagnostic tester applications for development, production and after sales.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

Contact: Ms. Stefanie Köhler, Mail: stefanie.koehler@kpit.com

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Kratzer Automation AG

KRATZER AUTOMATION provides innovative, turn-key software for testing efficiency covering the entire spectrum from test automation in real time over full corporate data integration up to efficient optimization of your testing results. We also deliver complete and individually configured test benches for the automotive industry.

PAoptimizer

Type	Optimization system
Functionalities	Optimization system supporting the complete design chain from DOE, measurement, modeling, evaluation, optimization, support of ECU calibration tools.
ASAM Standards	ASAM ACI, ASAM MCD-3

PAtools®

Type	Open test system
Functionalities	Open test system functionalities: Free configurable test bench automation system for all types of test benches in research and development and quality assurance.
ASAM Standards	ASAM MCD-3

testXplorer

Type	Test data management system
Functionalities	Free configurable functions for central data storage and archiving, data integrity check, web-based retrieval, process support in the test center with functions for order management, test bench planning, SAP-interface and traceability.
Supported ASAM Standards	ASAM CEA, ASAM ODS

Contact: Ms. Constanze Sedlaczek, Mail: testsystems@kratzer-automation.com

Gutenbergstr. 5
85716 Unterschleissheim / Munich, Germany

Phone + 49 89 32152 100
Fax + 49 89 32152 599

www.kratzer-automation.com

Offices
DE constanze.sedlaczek@kratzer-automation.com
FR jacques.trepant@kratzer-automation.com
CN florazhao@kratzer-automation.com

Baiernstr. 122A
8052 Graz, Austria

Phone + 43 316 5995 0
Fax + 43 316 5995 1080

www.ksengineers.at

Kristl, Seibt & Co GmbH

Kristl, Seibt & Co GmbH (KS Engineers) has been delivering solutions in the business fields of automotive engineering, industrial automation and building facilities for the past 30 years: some 240 employees manage projects in these fields worldwide.
Making optimum use of the synergies created between the technological fields of mechanics, control engineering, data engineering and building facilities, KS Engineers are extremely competent partners and have the experience to handle comprehensive turnkey projects highly efficiently

Tornado

Type	Test bed automation system
Functionalities	The KS Tornado software package provides measurement, control and report functions for test benches and is optimized for engine and chassis dynamometer test stands, power train test benches and vehicle component test rigs.
ASAM Standards	ASAM ACI, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-3, ASAM ODS

Contact: office@ksengineers.at

Schönherrstr. 8
09113 Chemnitz, Germany

Phone +49 371 5607 741
Fax +49 371 46409794

www.meskom.de

Offices
DE info@meskom.de

M&K Mess- und Kommunikationstechnik GmbH

M&K is a software house that offers systems for analysis and diagnosis of communication software and interfaces. We specialize in the development of software for the areas of device integration and connection of physical interfaces. This also includes software development for embedded systems and middleware for embedded device integration. Our focus is to provide development services for ASAM solutions to seamlessly connect tools from application level down to individual devices. M&K offers development and diagnostic tools for the creation, interactive testing and analysis of ASAM interfaces and products. Furthermore, we are conducting trainings and offer consulting services for ASAM solutions. For ASAM GDI, we offer a complete tool chain including development tools and a middleware solution as runtime environment. M&K develops test cases and realizes the frameworks for testing.

an@coord

Type	GDI Warehouse - Runtime Environment; Platform Windows and Linux, available as source code or run time licence
Functionalities	Individual adapted Coordinator with specific optimization features (performance, memory, security, ...) and C++ Technology Reference; string overloaded data type interface for shortcut service based configuration (description of DCD\'s by application); PID support; device drivers of any alignment useable.
ASAM Standards	ASAM GDI

an@dapt

Type	GDI Warehouse - Runtime Environment; Platform Windows and Linux, available as source code or run time licence
Functionalities	Platform adapter for operating system independent Device drivers
ASAM Standards	ASAM GDI

an@mod

Type	Warehouse Development Tools; Development and diagnostic tools for creation, interactive testing and analysis of ASAM interfaces and products
Functionalities	graphical UML GDI Device model generator and generation of the accomplishing DCD / DIT / Dll files. Released GDI Companion DCD of MCD3 OO model was generated by an@mod.
ASAM Standards	ASAM GDI

an@pact

Type	GDI Warehouse - Runtime Environment; Platform Windows and Linux, available as source code or run time licence
Functionalities	Communication Types GDI_IP (TCP/IP, UDP/IP) and GDI_COM
ASAM Standards	ASAM GDI

an@pars

Type	Warehouse Development Tools; Development and diagnostic tools for creation, interactive testing and analysis of ASAM interfaces and products
Functionalities	GDI and MCD parser and semantic checker with data access
ASAM Standards	ASAM GDI, ASAM MCD-2 MC (ASAP2/A2L)

an@skel

Type	Warehouse Development Tools; Development and diagnostic tools for creation, interactive testing and analysis of ASAM interfaces and products
Functionalities	C++ Skeleton generator for GDI Device Driver; automatic user code integration through directed programming and reengineering
ASAM Standards	ASAM GDI

an@stub

Type	Warehouse Development Tools; Development and diagnostic tools for creation, interactive testing and analysis of ASAM interfaces and products
Functionalities	Object oriented application generation based on DCD classes ;Efficient application generation for testing of application sequences and effective usage of devices drivers; available for C++ and Python; Stub classes encapsulate GDI specific Coordinator access (Coordinator API version independent); Profile independent usage of GDI device drivers; automatically serialization of data types described by DCD for stream oriented data exchange
ASAM Standards	ASAM GDI

an@test

Type	Warehouse Development Tools; Development and diagnostic tools for creation, interactive testing and analysis of ASAM interfaces and products
Functionalities	The goal of the test application is the development and verification of ACI server solutions. Execution of defined test cases based on ACI test catalogue and evaluation of result. Initial (re-entry), repetition and acceptance test are possible. In case of error, faults are analyzed and a diagnosis is made. Additional test cases can be modified for application specific procedures. Results of the test application are comparable and reproducible.
ASAM Standards	ASAM ACI

an@vis

Type	Warehouse Development Tools; Development and diagnostic tools for creation, interactive testing and analysis of ASAM interfaces and products
Functionalities	Interactive online testing of device drivers with analysis and visualization
ASAM Standards	ASAM GDI

iMCa

Type	MATLAB High Performance connector between AUSY, MATLAB and MC-System
Functionalities	The iMCa (intelligent multi-client adapter) allows the access from different clients to ECU via a MC-System for high speed data measurement and calibration of characteristics. A sample time from 4 ms is guaranteed. The solution allows an easy integration in existing test benches or alternatively the realization of automation tasks via MATLAB applications. Transient and dynamic system state illustration allows closed loops. Additionally a bidirectional process value exchange between MATLAB and AUSY is possible. Different MATLAB instances can run in parallel. MATLAB in connection with iMCa can be used as standalone automation system. With iMCa it is possible to extend an existing test bench environment with a MATLAB access. The MCA MATLAB user is independent from the knowledge of communication protocols. The MCA .NET interface can be used in C#, C++ and IronPython additionally.
ASAM Standards	ASAM ASAP3

Training

Type	Consulting and coaching (also inhouse available)
Functionalities	Support from modeling up to running GDI device drivers; Usage and work principle of GDI Coordinators; Capabilities of MCD-3 OO model; Integration and migration is considered.
ASAM Standards	ASAM MCD-3 D, ASAM MCD-3 MC, ASAM GDI

Contact: Mr. Bernd Wenzel, Mail: wenzel@meskom.de

MAHA-AIP GmbH & Co. KG

Hoyen 30
87490 Haldenwang, Germany

Phone + 49 8374 585 0
Fax + 49 8374 585 551

www.maha-aip.com

MAHA-AIP (Automotive Industry Products), located in South-Germany, designs and manufactures various test stands for light-, medium- and heavy-duty vehicles, motorcycles and ATVs for vehicle manufacturers, their sub-suppliers and certification labs (EPA, NIER, JRC, CARB etc.). Test drives can be simulated indoors with reproducible results on roller test stands (rolling roads) to improve product quality and optimize costs.

Contact: Mr. Manfred Dittrich, Mail: Manfred.Dittrich@Maha.de

MathWorks GmbH

Friedrichlandstr. 18
52064 Aachen, Germany

Phone + 49 241 4757 6700
Fax + 49 241 4757 6710

www.mathworks.com

Offices
US info@mathworks.com
GB info@mathworks.co.uk
FR info@mathworks.fr
IT info@mathworks.it
SE info@mathworks.se

The MathWorks is the world's leading developer of technical computing software for engineers and scientists. With an extensive product set based on MATLAB and Simulink®, The MathWorks provides software and services to solve challenging problems and accelerate innovation in automotive, aerospace, communications, electronics, instrumentation, process and other industries.

MATLAB

Type	Technical computing environment
Functionalities	High-level programming language for numeric computation, data analysis and visualization, system design and other technical applications. MCD-2 data can be imported into MATLAB using various third-party add-ons.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

Real-Time Workshop Embedded Coder

Type	ECU production code generation
Functionalities	Real-Time Workshop Embedded Coder provides production code generation for Simulink models, designed for embedded systems development. Real-Time Workshop Embedded Coder generates optimized ANSI-C code for fixed-point and floating-point microprocessors, plus automatic generation of MCD-2 data definition file.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

Simulink

Type	Model-based Design environment for modeling and simulation
Functionalities	Block-diagram environment for modeling, simulating, analyzing and generating code for prototyping, hardware-in-the-loop and production code generation. MCD-2 data can be imported for use with Simulink models using MATLAB programming.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

Target Support Package

Type	Target-specific extension for Real-Time Workshop Embedded Coder to support multiple embedded targets
Functionalities	Includes blocks for use with Simulink and Real-Time Workshop Embedded Coder, providing support for CCP (CAN Calibration Protocol) and creates a MCD-2 data definition file for the generated C code and automatically inserts memory address attributes for variables and parameters (dependent on selected target).
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-2 MC (ASAP2/A2L)

xPC Target

Type	Rapid control prototyping and HIL system
Functionalities	xPC Target is a solution for prototyping, testing and deploying real-time systems using standard PC hardware. It is an environment that uses a target PC, separate from a host PC, for running real-time applications. It can connect to CAN calibration tools, such as Vector CANape, using an XCP interface.
ASAM Standards	ASAM MCD-1 XCP

Contact: Mr. Guido Sandmann, Mail: guido.sandmann@mathworks.de

measX GmbH & Co. KG

Trompeterallee 110
41189 Moenchengladbach, Germany

Phone + 49 2166 9520 0
Fax + 49 2166 9520 20

www.measx.com

MeasX offers complete test and data management systems for component and electronics testing in the automotive industry. This includes test rig automation, data acquisition, data analysis and storage. Based on standard hardware and software tools, measX systems are efficient, flexible and cost effective.

MVA-PC

Type	Engine test data evaluation and reporting
Functionalities	DIAdem(R) based solution optimized for the requirements of engine test data analysis. Automatic generation of standard reports including data evaluation via formulas and scripts. Management of evaluation methods, formulas, layouts on different levels (user related, company standards). Batch processing of evaluations and report generation.
ASAM Standards	ASAM ODS

X-Frame

Type	Data evaluation and data management system
Functionalities	Ready to use solution and development platform for DIAdem(R) based data evaluation applications. Covers data management, evaluation, management of evaluation methods and formulas, reporting, user management, parameter and layout management. Open interface for customizing. Implemented applications include: Data management and analysis of long-term drive and handling tests; Link of individual component test rigs into the ODS environment; Management of tests, test samples and results in a companywide ASAM ODS environment.
ASAM Standards	ASAM ODS

Contact: Mr. Joachim Hilsmann, Mail: joachim.hilsmann@measx.com

Meidensha Corporation

ThinkPark Tower 2-1-1, Osaki
141-6029 Tokyo, Japan

Phone + 81 3 6420 7751
Fax + 81 3 5745 3066

www.meidensha.co.jp/epages/top/index.html

Offices
US hide.miura@meidenamerica.com
GB yanagiya@meiden.co.uk
KR hatta-a@meidenkorea.com

The quality and reliability of the Meiden Dynamometer has been established on a worldwide basis and the company continues to expand its reputation in all areas of dynamometer systems, i.e. drive simulation and analysis, test rigs, data acquisition and analysis, computer systems.

MEIDACS-DY6000P

Type	Data acquisition and control
Functionalities	Data acquisition and test automation for engine, vehicle and vehicle components
ASAM Standards	ASAM ACI, ASAM MCD-3

Contact: Mr. Takuya Ito, Mail: ito-taku@mb.meidensha.co.jp

MFP GmbH

MFP creates tailored solutions for Test Automation and Manufacturing Execution. Our recent development is an application for optimising the material flow in production, based on the interaction of several software agents with ASAM GDI interface. The execution system controls a just-in-time production in real-time, based on RFID-measurements and adapting to unforeseen events.

An der Corvinuskirche 22-26
31515 Wunstorf, Germany

Phone + 49 5031 13790
Fax + 49 5031 15687

www.mfp-online.de

Aptovia

Type	Application for adaptive material flow control
Functionalities	Report current material position; Control any transport system; Integrate express orders
ASAM Standards	ASAM GDI

MAGUS

Type	Software for supplier independent device configuration
Functionalities	Device independent planning of automation and measurement applications; Automated device configuration from application parameters
ASAM Standards	ASAM GDI, ASAM ODS

Contact: Mr. Dr. Robert Patzke, Mail: robert.patzke@mfp-online.de

Müller-BBM VibroAkustik Systeme GmbH

Müller-BBM VibroAkustik Systeme is one of the leading suppliers of vibroacoustic measurement technology for the interpretation of dynamic data, particularly in the fields of acoustics, vibration and strength. Our engineering expertise and competence for the measurement tasks at hand results in innovative solutions that seamlessly integrate into existing system environments. As one of the ASAM foundation members, we demonstrate enduring ASAM ODS expertise. This is reflected in our involvement in the definition of standards including the definition of the format for digital bus data, NVH or geometry.

MÜLLER-BBM
VibroAkustik Systeme

Robert-Koch-Straße 13
82152 Planegg, Germany

Phone +49 89 85602 400
Fax +49 89 85602 444

www.MuellerBBM-vas.com

Offices

US	info.us@MuellerBBM-vas.com
FR	info.fr@MuellerBBM-vas.fr
CN	info.cn@MuellerBBM-vas.com
KR	info@MuellerBBM-vas.co.kr
GB/BX	DdeKlerk@muellerbbm-vas.nl

Edp

Type	Web-based engineering data portal
Functionalities	Interactively browse, query and analyze ASAM ODS data in the internet browser. Access to ASAM ODS data - especially NVH data (ODS-relational database, OO-API, ATF/XML). Data processing (depiction of sum levels, nth octaves and orders, statistical calculation, data mining, audio). Export of stored data and processing results. Presentation of interactive graphics (SVG - scalable vector graphics). Creation of high quality VAS Graphics2Go® packages for interactive Microsoft® Office integration. Supported ASAM standards: ASAM ODS V5.1, V5.2, V5.3; NVH and Geometry data model; ASAM ODS data access with OO-API; exchange format ATF/XML.
ASAM Standards	ASAM ODS

MÜLLER-BBM
VibroAkustik Systeme

PAK

Type	Dynamic Data Measurement and Analysis System
Functionalities	Data acquisition: fast, static, digital (CAN, FlexRay™, EtherCAT®) channels; limitless channel counts. Data analysis: real-time analysis; selectable track parameters; configurable measurement descriptions; ASAM ODS based; user-configurable quantity catalog; system-independent data viewing based on ATF/XML; interactive graphics; creation of high quality VAS Graphics2Go® packages for interactive Microsoft® Office integration. Supported ASAM standards: ASAM ODS V5.1, V5.2, V5.3; NVH, Geometry and Bus data model; database; exchange format ATF/XML.
ASAM Standards	ASAM ODS

PAK capture suite

Type	Data acquisition system
Functionalities	Data acquisition: fast, static, digital (CAN) channels; Interactive operation via smart devices or as standalone unit; Time recordings – manually or triggered; Supported ASAM standards: ASAM ODS V5.2, V5.3; NVH; Native writing of ATF/XML format.
ASAM Standards	ASAM ODS

Contact: Mr. Florian Kluiber, Mail: info.de@MuellerBBM-vas.de

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NATIONAL INSTRUMENTS™

11500 N. Mopac Expwy
78759-3504 Austin, USA

Phone + 1 512 683 0100
Fax + 1 512 683 8411

www.ni.com/asamods

Offices
National Instruments is a worldwide organization with direct operations in more than 40 countries and a presence in almost every region of the world.

National Instruments Corporation

National Instruments is the leader in Graphical System Design and offers sophisticated hardware and software products. Found at nearly every automotive OEM and Tier 1 supplier, our tools save time and money across all stages of the automotive engineering process by providing a common platform. NI's revolutionary concept has changed the way engineers and scientists approach measurement and automation, through industry-leading I/O, flexible off-the-shelf hardware and the powerful software development environments, to create user-defined solutions for applications ranging from End-of-Line and infotainment test to in-vehicle data logging and embedded software validation.

ECU Measurement and Calibration Toolkit

Type	Add-on for ECU measurement and calibration.
Functionalities	The NI ECU Measurement and Calibration Toolkit extends the NI LabVIEW, NI LabWindows™/CVI, and Microsoft C/C++ development environments to support measurement and calibration applications for the design and validation of electronic control units (ECUs).
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L)

NI DataFinder Server Edition

Type	Centralized ASAM ODS compliant data management software
Functionalities	NI DataFinder Server Edition is an ASAM ODS server which works out-of-the-box by indexing test files with no need for IT support or database knowledge. NI DataFinder Server Edition integrates easily into existing systems and offers the indexed data through an ASAM ODS CORBA interface.
ASAM Standards	ASAM ODS

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PAK

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type testing, COP, development

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www.MuellerBBM-vas.com

NI DIAdem

Type	Data management, analysis, report generation a. script based automation.
Functionalities	NI DIAdem is a single software tool that can be used to quickly locate, load, visualize, acquire, analyze, and report measurement data collected during data acquisition and/or generated during simulations.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM ODS

NI LabVIEW

Type	Graphical System Design based application development environment (ADE).
Functionalities	Graphical System Design software that provides engineers and scientists with the tools needed to create and deploy measurement and control systems through unprecedented hardware integration.
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM ASAP3

NI LabWindows™/CVI

Type	ANSI C based application development environment (ADE)
Functionalities	LabWindows™/CVI is a proven ANSI C development environment for engineers and scientists which increases productivity when creating test and measurement applications.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

NI TestStand

Type	Test Automation
Functionalities	NI TestStand is a ready-to-run test management software used for developing, executing, and deploying test and validation systems. Users can develop test sequences that integrate code modules written in any test programming language. Sequences also specify execution flow, reporting, database logging, and connectivity to other enterprise systems.
ASAM Standards	ASAM XIL

NI VeriStand

Type	Application development environment (ADE) for real-time testing applications.
Functionalities	NI VeriStand is a powerful out-of-the-box software environment for configuring and performing real-time testing applications, such as HIL, MIL, SIL and test cells more efficiently.
ASAM Standards	ASAM XIL, ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM ASAP3

NI-XNET

Type	Hardware Driver
Functionalities	High-performance driver software technology behind NI's CAN, LIN, and FlexRay interfaces for PCI, PXI and NI C Series, which provides a set of driver software and APIs for NI LabVIEW, NI LabWindows/CVI, and C/C++ on Windows and LabVIEW Real-Time OSs.
ASAM Standards	ASAM MCD-2 NET (FIBEX)

Contact: Ms. Stephanie Amrite, Mail: stephanie.amrite@ni.com

OnoSokki Co., Ltd.

We, Ono Sokki Co., Ltd., are designing and manufacturing the measurement and control system for automobile testing and development. Also the instruments for analyzing the noise and vibration are available on our production line.

Engine Test Bed

Type	FAMS8000
ASAM Standards	ASAM ACI, ASAM MCD-3 MC

ORANGE

Type	OP-3000
Functionalities	ECU Calibration
ASAM Standards	ASAM MCD-3 MC

Contact: Mr. Yu Kumakura, Mail: kumay@onosokki.co.jp

3-9-3 Shin-Yokohama, Kohoku-ku
222-8507 Yokohama, Japan

Phone + 81 45 935 3888
Fax + 81 45 470 7242

www.onosokki.co.jp/English/english.htm

ORME

ORME is a French company located in Toulouse, specializing in signal and image processing. ORME has based its activities on its know-how and on a close relationship with its customers to fit their needs. ORME realizes specific algorithm studies and software developments as well as training. ORME also develops and commercializes its own software for data analysis: TrackImage (image sequence analysis) and TrackReport (test analysis and reporting).

TrackReport

Type	Software
Functionalities	Automatic test analysis and reporting
ASAM Standards	ASAM ODS

Contact: Mr. Luc Oriat, Mail: luc.oriat@orme-toulouse.com

Centre d'Activités "La Rue", Bat 11,
rue Pierrre Gilles de Gennes, BP 58 140
31681 LABEGE CEDEX, France

Phone + 33 56100 2570
Fax + 33 2680 56100

www.orme-toulouse.com

Parametric Technology Corporation

PTC unterstützt mit seiner Integrity-Business Unit Unternehmen dabei, ihre Softwareentwicklung zu optimieren und für kontinuierliche Innovationen zu sorgen. Gleichzeitig werden die Komplexität der Software reduziert, Zykluszeiten verkürzt und in allen Entwicklungsstufen Risiken minimiert. Unsere Softwareentwicklungsplattform Integrity ist die einzige einheitliche Plattform, die alle Funktionalitäten für die Zusammenarbeit und Kontrolle von Entwicklungskomponenten und -aktivitäten umfasst. Unsere schnell anpassbaren Lösungen sind für 10 bis 10.000 Benutzer in unterschiedlichen Funktionen geeignet. Sie lassen sich problemlos mit ähnlichen Systemen integrieren und haben sich in den Umgebungen anspruchsvoller globaler Unternehmen vielfach bewährt.

Integrity, a PTC product

Type	Application Lifecycle Management System
Functionalities	Requirements Management, Architecture Management, Change Management, Test Management, Traceability
ASAM Standards	ASAM Issue

140 Kendrick Street
02494 Needham, MA, USA

Phone + 1 781 370 5000
Fax + 1 781 370 6000

www.ptc.com

Offices
DE integritygermany@ptc.com
CA integrityinfo@ptc.com

PTC®

Source, a PTC product

Type	Software Configuration Management
Functionalities	Integrated Configuration and Change Management. Full traceability to Requirements and Models. Integration in Test Management.
ASAM Standards	ASAM CC

Contact: Mr. Thomas Hornek, Mail: integritygermany@ptc.com

Peak Solution GmbH

Lina-Ammon-Str. 22
90471 Nuremberg, Germany

Phone +49 911 800 927 30
Fax +49 911 800 927 99

www.peak-solution.de

Offices
CN shanghai@peak-solution.com

Peak Solution is focused on the design and implementation of software applications for the planning, description, evaluation and documentation of tests. The solutions are based on standardized, flexibly adjustable software components which, thanks to their open interfaces, can be integrated smoothly into existing application and system landscapes. Special focus is placed on the use of applicable standards like ASAM ODS.

openMDM based systems

Type	An open and manufacturer independent open source software platform for the implementation of company-wide test and measurement data management solutions
Functionalities	Proven software modules for test definition and order placement as well as storage, search and exchange of measurement data, customizable application model, interfaces to many measurement systems and data formats, like e.g. DIADEM, FAMOS, Excel, etc.
ASAM Standards	ASAM ODS

Peak ODS Server

Type	Peak ODS Server offers standardized methods and interfaces for saving and reading test data on the basis of ODS
Functionalities	Peak ODS Server supports the ASAM standards ODS 5.3, ODS Mixed Mode and ODS Extended Query. It is optimized for use in connection with the measurement data management framework openMDM. But also other data acquisition, automation and analysis systems can be expanded fast and cost-effectively to access ODS databases using the Peak ODS server. Providers who would like to use the Peak ODS Server in their own OEM solutions or customer projects will find that Peak Solution has a fair partner concept with interesting conditions. The Peak ODS server works with Oracle and MS-SQL data bases.
ASAM Standards	ASAM ODS

Professional services for openMDM

Type	Professional services for the implementation of company-wide test and measurement data management solutions
Functionalities	Consulting, system set-up, customizing, software development, system integration, support and maintenance for the open MDM framework
ASAM Standards	ASAM ODS

Contact: Mr. Guido Schneider, Mail: g.schneider@peak-solution.de

PEAK-System Technik GmbH

Otto-Röhm-Str. 69
64293 Darmstadt, Germany

Phone + 49 6151 8173 20
Fax + 49 6151 8173 29

www.peak-system.com

Founded in 1999, PEAK-System Technik is a leading provider of hardware, software, and services for the industrial communication with emphasis on the field busses CAN and LIN. The product range includes:

- CAN/LIN interface modules for common PC hardware interfaces (PCI, cPCI, Mini PCI, PCI Express Mini, PCIe, PC/104, USB, PC Card, and ExpressCard)
- Configurable and programmable microcontroller hardware with CAN interfaces for individual developments, measurement data acquisition, and control applications
- Various software products for Windows® 7, Vista, and XP, used for diagnosis, monitoring, and influencing CAN and LIN networks

In addition to development as well as distribution and trade of hardware and software products, PEAK-System Technik provides know-how in form of different services:

- Custom-designed hardware and software development as well as hardware adjustments

Production of PCB layout, including board fabrication and equipment if desired - from prototype to series

- Creation of user manuals, maintenance instructions, as well as any kind of technical documentation

PEAK-System Technik belongs to the PEAK group (www.peak-international.com).

PCAN-CCP API

Type	API / Programming Interface
Functionalities	Free CCP programming interface. Uses the programming interface PCAN-Basic (also free of charge) for accessing the CAN hardware in the computer. Physical communication via CAN using a CAN interface of the PCAN series by PEAK-System. One API function for each command on the CCP standard. Additional commands for communication management.
ASAM Standards	ASAM AE MCD-1 CCP

PCAN-XCP API

Type	API / Programming Interface
Functionalities	Free XCP programming interface. Uses the programming interface PCAN-Basic (also free of charge) for accessing the CAN hardware in the computer. Physical communication via CAN using a CAN interface of the PCAN series by PEAK-System. One API function for each command on the XCP standard. Additional commands for communication management.
ASAM Standards	ASAM AE MCD-1 XCP

Contact: Mr. Uwe Wilhelm, Mail: info@peak-system.com

PikeTec GmbH

Waldenserstr. 2-4
10551 Berlin, Germany

Phone + 49 30 39 40 96 83 0
Fax + 49 30 39 40 96 83 90

http://www.piketec.com

PikeTec is a software company specialized in functional testing and verification of ECU software. For this, PikeTec created the tool TPT which supports systematic automated test of control software. Testing Simulink-models works as well as testing ASCET-models or C-Code. TPT supports MiL, SiL or even PiL and HiL testing procedures.

Test Consulting

Type	Consulting
Functionalities	We provide support for designing test processes and test methodologies.

Test Engineering

Type	Engineering
Functionalities	We do testing of all kind of automotive control software like powertrain controller, body controller, drive dynamics controller etc.

TPT

Type	Testing tool
Functionalities	TPT is a model based testing and verification tool for control systems. TPT supports modeling of reactive testing, real-time testing, automatic test execution on e.g. Simulink or ASCET models, C-Code, PiL or HiL. Tests are evaluated and reported automatically. Requirements tracing and testing according to ISO26262 is possible.
ASAM Standards	ASAM MCD-3 MC

Contact: Mr. Jens Luedemann, Mail:info@piketec.com

Polytec GmbH

Polytec-Platz 1 - 7
76337 Waldbronn, Germany
Phone + 49 7243 604 186
Fax + 49 7243 699 44

www.polytec.de

Offices
US info@polytec.com
FR info@polytec.fr
JP info@polytec.co.jp

Polytec is a global corporation with facilities in Europe, North America and Asia. It is the worldwide leading supplier for non-contact laser Doppler vibration measurement systems. Polytec's innovative measurement solutions allow our customers to maintain their own technical leadership in markets from automotive and aerospace to micro technology.

PSV-500 Scanning vibrometer

Type	Scanning Vibrometer
Functionalities	Full-field vibration measurement for testing of acoustic materials
ASAM Standards	ASAM ODS

PSV-500-3D-H 3D Scanning Vibrometer

Type	3D Scanning Vibrometer
Functionalities	Full-field vibration measurement for NVH and structural dynamic testing
ASAM Standards	ASAM ODS

RoboVib Structural Test Station

Type	Automated Modal Testing
Functionalities	RoboVib is a robotic experimental modal test station utilizing non-contact Laser Doppler Vibrometry for sample probing. The main purpose is the validation of structural dynamic models on component level up to for full car bodies. RoboVib is offered as solution for NVH labs or as a measurement service by Polytec GmbH for Europe or Polytec Inc. for the United States
ASAM Standards	ASAM ODS

Contact: Mr. Jörg Sauer, Mail: j.sauer@polytec.de

QTronic GmbH

Alt-Moabit 92
10559 Berlin, Germany

Phone +49 30 3512 1067
Fax +49 30 3036 4941

www.qtronic.de

QTronic provides tools and services for model-based development. Our outstanding software tools are used by developers at Mercedes-Benz, AMG, BOSCH, ZF, IAV, Continental, Toyota, Honda, SAIC and others. Silver and TestWeaver support highly automated validation and test of virtual ECUs on Windows PCs. This helps to identify design problems much earlier and faster with much lower costs than ever possible.

Silver

Type	Virtual ECU on Windows PC
Functionalities	Silver is a tool used by automotive development engineers to simulate ECUs in closed loop with a vehicle model on Windows PC. This way, work on control development, test, and calibration can be selectively shifted from road, test rigs, and HiL to Windows PC where it can be performed faster, cheaper and without blocking limited resources. Silver provides built-in support for automotive standards such as ASAP2/A2L, MDF, CAN, and XCP to perform co-execution of control software and of vehicle simulation models. Silver also supports the FMI (Functional Mockup Interface), which greatly simplifies the import of models from simulation tools such as Dymola, SimulationX, MapleSim, AMESim, SIMPACK or JModelica into the Silver environment. Silver is a product partner of The MathWorks, which translates into seamless integration of Silver into the MATLAB®/Simulink tool chain. Silver can be connected to CANape or INCA for measurement and calibration, or can be used for rapid-control prototyping via CAN. Silver provides interfaces for test automation with Python, TestWeaver, ECU-TEST, TPT and others. Advanced testing support: range check for all measurements and characteristics, detection of common software bugs, measurement of speed and stack consumption for ECU tasks, back-to-back tests, code coverage and other criteria recommended by ISO26262. Silver is in use for control development at Mercedes-Benz, BMW, AMG, IAV, Continental and others.
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MDF

TestWeaver

Type	Automated System Validation
Functionalities	TestWeaver (testing without test scripts) is a tool that autonomously searches for weak points and bugs in control software and calibration data. Users have to supply a simulation model (implemented e.g. using MATLAB®/Simulink, Silver or HiL) and to specify computable quality indicators. TestWeaver constructs automatically driving scenarios that minimize these indicators. This helps to find bugs early and with much less effort than otherwise possible. A typical ECU(software + calibration data) is checked within 24 hours on a standard PC. The automatic test case generation of TestWeaver can run with MiL, SiL, or HiL setups and allows to achieve a much higher test coverage with less effort than otherwise possible. TestWeaver is in use for software development at Mercedes-Benz, AMG, Bosch, ZF, SAIC and others.
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MDF

Contact: Mr. Jakob Mauss, Mail: jakob.mauss@qtronic.de

Zeiloch 6a
76646 Bruchsal, Germany

Phone +49 7251 3862 0
Fax +49 7251 3862 11

www.rac.de

RA Consulting GmbH

RA Consulting offers software tools, programming for embedded systems as well as classic IT and consulting services for the automotive and other industries. RAC is ORACLE Gold Partner.

CalveRA

Type	Expert system for project independent processing of application data
Functionalities	CalveRA is a standard server-oriented software for the knowledge-based validation of parameter data sets in ECU software. The special knowledge is entered into CalveRA by experts into special, restricted parameter data sets. Development engineers in different projects can resort to this knowledge. From the parameter data inside CalveRA, reference parameter sets can be created which are then used to validate the results of the development engineers. By these means the experience from historical projects can be reused. Furthermore the reference data set can be used as suggestion for the application data, allowing new, manifold projects to be dealt with. Label list are imported out of A2L description files. DCM calibration data files are used to import the specific data sets that have to be validated against the expert data in CalveRA and to export the reference data sets as basic data for new application projects.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

DiagRA D

Type	Diagnostic tool
Functionalities	Diagnostics tool DiagRA D with support for ISO9141, ISO 14230, ISO 15765, ISO 14229 (UDS). Specific workshop tester functions for several OEM. Complete OBDII / EOBD / HD-OBD (SAE J1979/SAE J1939) scantool with WWH-OBD (World Wide Harmonized – Onboard Diagnostics). Support for the Open Source SAE J1699-3 OBDII Compliance Test Cases tool. SAE J1699-3 tool log-file formatter with outputs as XML or PDF files. Own implementation of the SAE J1939-84 OBD Communications Compliance Test Cases for Heavy Duty Components and Vehicles. These OBDII / EOBD / HD-OBD / WWHOBD functionalities are also available as single tool Silver Scan-Tool. Advanced functions for developers work with MCD-2 MC (ASAP2) and CANdb files. These functions permit to read out and display the internal fault code memory of ECUs in full, display the status of the diagnostics functions, read out RAM cells, adaptation ID fields etc. Remote control via Windows DDE, ASAP3 and WebServices after ASAM HIL-API. MCD-2 D (ODX) description set import for parameterization of UDS on ISO-CAN diagnosis. Flash programming and script execution plug-ins available. Diagnostics and flash programming on FlexRay supported.
ASAM Standards	ASAM HIL, ASAM MCD-1 CCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MCD-3 D, ASAM XIL

DiagRA MC

Type	Measurement and calibration tool
Functionalities	Measurement tool DiagRA M with support for MCD-1 (CCP/XCP), CANdb, SMB (serial management bus) and for measurement data accessed by DiagRA D. Calibration tool DiagRA C for adjustment (CCP/XCP) of parameters as well as characteristic curves and fields with

RA Consulting GmbH is a German based software engineering company. The RA® software products primarily support development departments of worldwide more than 200 prominent international car manufacturers and their 1-tier suppliers in the diagnostics, measurement and calibration field.

RA® Automotive Products

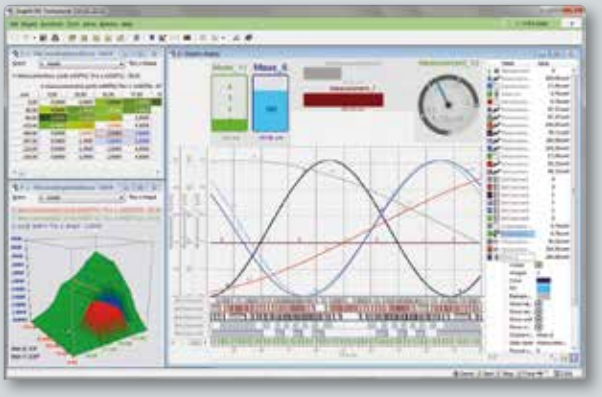
DiagRA® MCD

Features:

- Superior tools in an integrated package:
  - DiagRA M – Measurement
  - DiagRA C – Calibration
  - DiagRA D – Diagnostics
- Support of CAN, K-Line, FlexRay, SMB and Ethernet
- Minimal hardware requirements
- Optional plugins for flash programming, remote control and scripting

Protocols and file formats:

CCP, XCP, KWP2000, UDS, MCD-2 MC ASAP2/A2L, MCD-2 D ODX, MCD-2 FIBEX, CANdb, MDF, DCM and many more



RA®ODX VIEWER Next Generation

To display and filter diagnostic data from ODX containers and to export them to various target data formats.

Functions:

- support of the ODX standards 2.0.1, 2.1.0 and 2.2.0
- manufacturer-specific configurations
- import of PDX containers
- display of the parameters and their calculations in a detail window
- freely definable, storable filters and views
- export of data to various output formats CSV, XML, PDF
- integrated structural view through ODX Explorer

Standards:

ASAM MCD-2D (ODX), ISO 22901-1

RA Consulting is active in these ASAM projects:

ASAM POD Access • Extension of OTX (ISO 13209) • ASAM CSL (Calibration Sequence Language) with emotive GmbH • ASAM MCD-2 CERP: Data Description for Calibration Expert Systems (FVD) • ASAM MCD-1 XCP (FVD)

www.rac.de

ASAM Member

ORACLE® Gold Partner

etr Member of Equipment & Tool Institute

automotive engineering tool alliance AETA Member

www.aeta-rice.com

RA CONSULTING GmbH
Automotive Products

Zeiloch 6a
76646 Bruchsal · GERMANY
Tel. +49 (0) 7251 3862-0
Fax +49 (0) 7251 3862-11

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graphical and numerical display. Adjustment on-line and off-line. XCP on CAN, FlexRay and Ethernet. Integrated functionality for parameterization of DEPM (Diagnostics Error Path Manager). Data included in ODX can be compared with calibrated values in the A2L/HEX projects. ASAP3 interface for remote controlled measuring implemented.

ASAM Standards: ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MCD-3 MC, ASAM ASAP3

DiagRA MCD Toolset

Type: Integrated toolset for measurement, diagnostics and calibration

Functionalities: The DiagRA MCD Toolset is an applications and diagnostics tool for working with electronic control units in the automotive industry. It is an integration of the already widespread tools DiagRA M, DiagRA C and DiagRA D. It is used in the whole cycle of vehicle development, production and life.

ASAM Standards: ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MCD-3 D, ASAM MCD-3 MC, ASAM XIL, ASAM ASAP3

ODX-Viewer

Type: ODX data management tool

Functionalities: ODX viewer tool filters and displays the data out of ODX projects in several ways, arrange them well and exports complete or reduced data sets in several formats like XML, PDF and CSV.

Supported ASAM Standards: ASAM MCD-2 D (ODX)

Silver Scan-Tool

Type: OBDII/EOBD diagnostic tool

Functionalities: Complete OBDII / EOBD / HD-OBD (SAE J1979/SAE J1939) scantool with WWH-OBD (World Wide Harmonized – Onboard Diagnostics). Support for the Open Source SAE J1699-3 OBDII Compliance Test Cases tool. SAE J1699-3 tool log-file formatter with outputs as XML or PDF files. Own implementation of the SAE J1939-84 OBD Communications Compliance Test Cases for Heavy Duty Components and Vehicles. SAE J 2534 PassThru, RP1210A and D-PDU-API interface connection is supported.

ASAM Standards: ASAM XIL

Contact: Mr. Mario Hoppe, Mail: info@rac.de

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rd electronic gmbh

Arnikastr. 2
85635 Höhenkirchen, Germany

Phone+ 49 8102 8953 0
Fax+ 49 8102 8953 10

www.rd-electronic.com

Offices
US keith.butler@rd-electronic.com

rd electronic supports tools and systems for data management, device integration, test and automation systems for end-of-line test and integration frameworks for different computer platforms. In the area of ECUs rd electronic develops and manufactures on-board interfaces and controllers as well as real-time bus analyzers for all bus systems.

FLG

Type: Driver guide system for run-in and brake test stands

Functionalities: Driver guide system for run-in, diagnosis and brake test systems in end-of-line and development test stands. Connects to ECUs via radio trans-

	mission, test and driver guidance editor, online test compilation, test order and report integration, chassis dyno GDI integration platform, prepared for MCD-3 migration.
ASAM Standards	ASAM GDI

GDI Framework

Type	GDI Integration platform for Windows and Linux (RT)
Functionalities	Integration platform for ASAM GDI devices for test and automation systems. DLL, shared lib and Java coordinator interfaces. ASAM GDIV4.2/4.3/4.4 DCD/DIT parser integrated or stand alone. Macro engine for system persistence and setup procedures - GINA2010 compatible. Platform adapter for Windows and Linux include serial, IP4, CAN, CANopen, and USB.
ASAM Standards	ASAM GDI

Lexikon

Type	Metadata and Application Data Model Management
Functionalities	Web-based solution providing full metadata management services; (Parameter generation, Application Data Models, Equation). Capable of saving Business Rules for naming conventions, equation generation and model construction. Vendor and operating system independent, multilingual support from single licence to full enterprise version. Provides metadata integrity to ODS data repositories.
ASAM Standards	ASAM ODS

Services

Type	Consulting and co-engineering
Functionalities	rd electronic supports development of: ODS-Data models, ODS system architecture; GDI-Integration and driver development; CEA-Component development; MCD-Migration
ASAM Standards	ASAM CEA, ASAM GDI, ASAM MCD-3, ASAM ODS

SP Host

Type	Data management system
Functionalities	Automatic data scanning of test field data generating systems or hosts, scheduled operation of data conversion to ASAM ODS ATF and report generation, upload to ODS repositories, built in security related company authentication services, automatic archival, web based manual access to local and global test data, configurable components for test report generation. Vendor independent.
ASAM Standards	ASAM CEA, ASAM ODS

UBAT

Type	Universal Bus Analyzer for parallel real-time analysis
Functionalities	Monitoring, online analysis and complex triggering for any combination of CAN, MOST, K-Line, FlexRay, BSD, I-, K-, P-Bus. Programmable gateway and simulation procedures in any combination of up to 10 equal or mixed bus systems.
ASAM Standards	ASAM GDI, ASAM MCD-2 MC (ASAP2/A2L)

Contact: Mr. Jürgen Döring, Mail: juergen.doering@rd-electronic.com

Schleißheimer Str. 37
85748 Garching b. München, Germany

Phone + 49 89 5526189 0
Fax + 49 89 5526189 55

www.reliatec.de

ReliaTec GmbH

The ReliaTec is specialized in supporting their customers in the design and development of innovative products and services. As a technologically oriented innovation partner we apply our know-how in the development of software components and tools for networked real-time systems based on LIN, CAN, FlexRay and Ethernet.

ReliaFX Access	
Type	Software Product
Functionalities	FIBEX-Importer Library
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 D (ODX), ASAM MCD-2 NET (FIBEX)

Contact: Ms. Daniela Kirchhof, Mail: sales@reliatec.de

Goegginger Str. 73
86159 Augsburg, Germany

Phone + 49 821 5700 408
Fax + 49 821 5700 610

www.renk-testsystem.eu

Offices
US info.labeco@renk.biz

RENK Test System GmbH

RENK Test System GmbH, a member of the MAN-group provides various turnkey test systems for R&D and Quality Assurance applications customized for the automotive, aviation, wind turbine and railway industry for more than twenty years now. RENK also offers consulting for test system design as well as services, maintenance of test systems, technical support and training.

Contact: Mr. Mathias Karrer, Mail: info.testsystem@renk.biz

Einhornstr. 10
72138 Kirchentellinsfurt, Germany

Phone + 49 7121 9937 0
Fax + 49 7121 9937 177

www.samtec.de

Offices
RO contact-ro@samtec.de

samtec GmbH

Focused on vehicle communication technology for more than 25 years, samtec has developed itself into a supplier of cutting-edge software and hardware. samtec manufactures solutions to communicate with electronic control units on various bus systems. Both with ready to use products and by customer specific development projects samtec has proved itself as a reliable partner for the international automotive industry.

A2L Parser / ASAP2 / mcd-2 mc parser / SASlib

Type	A2L Parser / ASAP2 / mcd-2 mc parser
Functionalities	The library SAsLib offers access on ECU description-data, which are defined in ASAP2 files (.a21). Thereby the user does not need to know the format of the file in detail. You can easily embed the SAsLib into your application and via the calling of only few functions you can read, interpret the information of the ASAP2 file and also keep it ready in the RAM. The SAsLib on its own does not represent a measure- or application- or diagnostics-system according to the ASAP-definition, but simplifies and makes possible the production of such systems, since it offers a programming port (API) with a function for reading, interpreting („parse“) and access to all the files, which are included in the ASAP2 files. The SAsLib is delivered as a dynamic and linkable library (DLL). The interface is pure ANSI C and that is why it is possible to use it within different development

	areas such as: Microsoft Studio C / C++ / C#, Borland C/C++ Builder, MATLAB or VisualBasic. The library is available for Windows and Linux. The SAsLib.dll is based on the ASAP2-definition 1.31, whereas also older ASAP2-files can be processed. ASAP2 files of newer versions can be parsed with the SAsLib, as far as data-elements, which are added with this version, are not needed. If required the software of samtec can easily be adjusted to new requirements. Scope of delivery: - DLL - C-header files - Documentation - Demo application
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

Diagnostic Suite samDia

Type	Restbus simulation, Gateway, Diagnostic Tool
Functionalities	The Diagnostic Suite samDia unifies the functionalities control unit stimulator/tester, control unit simulator and protocol analyzer in the form of separate modules within a common entity. All programs can also be operated remotely and can be adapted to user defined tasks via scripts. Highlights - Import of FIBEX, AUTOSAR, CANdb- and LDF-files - Individually expandable through module toolkit - Modules for CAN, FlexRay, K-Line, SAE J1850, LIN – CAN analyzer and CAN sequencer - Internal script programming via Microsoft VBScript - Block sequencer with script function - Numerous protocol filters: e.g. ISO 15765, ISO 14229,ISO 14230 - Controllable through remote control via automation interface - Output of communication data in a graphical way Modules - CAN module - K-Line module (analyzer, stimulator, simulator, UART direct) - FlexRay module - LIN module - SAE J1708/J1587 module - SAE J1850 module - Block sequencer - Easy Datalogger (Freeware) - Vehicle simulation modul (Freeware)
ASAM Standards	ASAM MCD-2 NET (FIBEX)

samFibexRuntime API

Type	API
Functionalities	The ASAM Fibex standard has been evoked due to the general tendency of using standardised data formats in the automotive industry. Fibex describes the entire electronic car network as well as moreover the transmitted information beyond different bus systems. With the help of the samFibex component it is possible to create software for the car communication on the basis of our HS Plus and HSX interfaces, which are based on Fibex defined data. Therefore the user does not need any further detailed knowledge about Fibex. The simplified and user-friendly port offers the necessary flexibility and methodology for a manifold and easy usage. Furthermore the Fibex complexity is covert for you as user. Highlights - Supported formats: Fibex 2.0, Fibex 2.0.1, Fibex (2.0)+, Fibex 3.0, DBC, AUTOSAR 3.x in the planning stage -Signal based depiction and handling - Easy navigation into the Fibex hierarchy - Definition with simple XML description of special signal behaviours e.g. Alivecounter, CRC calculations or Toggle Bits - Dynamic generation of own signals (signals, which are not described in Fibex) - Signal value-conversion of physical data into raw data - Special frame/signal initialising-methods (Frame/Signal Fill Byte value) - Automatic dissolving of PDUS within frames with Fibex 2.0
ASAM Standards	ASAM MCD-2 NET (FIBEX)

Contact: Mr. Frank Heyden, Mail: frank.heyden@samtec.de

Am Kalkofen 10
61206 Nieder-Wöllstadt, Germany
Phone + 49 6034 9148 748
www.schleissheimer.de

Schleißheimer Soft- und Hardwareentwicklung GmbH

Schleissheimer GmbH specializes in Software and hardware development for microcontroller real-time Systems. The Company performs Software tests for the automotive industry. Schleissheimer develops Software and hardware products as prototypes or in small batches. Schleissheimer's portfolio includes the Software tools CanEasy and CanX for CAN/LIN bus development, analysis, and simulation.

Contact: Mr. Pascal Baumgärtner, Mail: baumgaertner@schleissheimer.de

Hagellocher Weg 73
72070 Tübingen, Germany
Phone + 49 7071 9457 0
Fax + 49 7071 9457 211
www.science-computing.de

science + computing ag

SCIENCE + COMPUTING AG (s+c) – founded in 1989 – is an IT-services and software development company operating in the fields of computer aided testing, engineering and design (CAT/CAE/CAD). s+c offers a broad spectrum of services related to the handling of huge amounts of engineering data: consulting and concepts, system analysis and integration, custom tool development, optimization of distributed systems, data management and operation of complex, heterogeneous IT-environments.

ASAM ODS consulting and integration

Type	Consulting, engineering, support
Functionalities	Consulting customers in the organization of their test data. Design of ASAM ODS application models. Implementation of ASAM ODS databases.
ASAM Standards	ASAM ODS

ASAM ODS database and version migration

Type	Consulting, engineering, support
Functionalities	Migrating engineering data to ASAM ODS databases. Migrating ASAM ODS based data or ASAM ODS databases to newer versions of the standard.
ASAM Standards	ASAM ODS

ASAM ODS server and Database operation

Type	Support and operations
Functionalities	1st and 2nd level support in the operation of ASAM ODS servers, underlying databases (i.e. Oracle) and servers, problem analysis and operations.
ASAM Standards	ASAM ODS

Software development

Type	Component based GUI application development, consulting
Functionalities	Mapping individual engineering processes into data management applications. Programming of individual GUI applications for comfortable access to ASAM ODS based data using rich client or web based applications. Integration of and integration in customer software. Using and utilizing standard software i.e. developing data management systems based on the openMDM framework http://www.openmdm.org
ASAM Standards	ASAM ODS

Contact: Mr. Dietmar Rapf, Mail: D.Rapf@science-computing.de

SGE Ingenieur GmbH

Freihamer Str. 2
82166 Gräfelfing, Germany

Phone + 49 89 85 83 61 60
Fax + 49 89 85 83 61 62

sge-ing.de

The SGE Ingenieur GmbH is specialized in ECU development for the vehicle and mobility industry. We provide ECU calibration, functional development, calibration and testbed automation, application development in MATLAB/SIMULINK and simulation model development for HIL/MIL/SIL/residual bus applications.

SGE Circus

Type	Software
Functionalities	Measurement Data Visualization and Analysis, Map Creation, Map Visualization and Optimization
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L), ASAM MDF

Contact: Mr. André Sell, Mail: andre.sell@sge-ing.de

Siemens AG

Gleiwitzer Str. 555
90475 Nuremberg, Germany

Phone +49 911 895 2533
Fax + 49 911 895 5425

www.industry.siemens.com/verticals/global/de/automobilproduktion

For 35 years Siemens is delivering test systems for the automotive industry and automotive suppliers and leverage the long term experience to build optimized solutions. The ASAM solutions ASAM MCD-3D server, ASAM MCD 2D (ODX) and ASAM GDI are integral part of the Siemens SIDIS Pro test software and can be used from administration, test authoring and execution.

SIDIS Authoring

Type	Editor
Functionalities	The SIDIS Pro authoring suite is used to design all test routines required in the production environment. The suite takes advantage of the integrated ASAM MCD 2D (ODX) and the ASAM GDI interface as well as the import of OTX routines. The graphical user interface with the Flow view allows the easy design of the test flow. A full implemented version control system enables a comprehensive support of the complete releasing process.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D, ASAM GDI

SIDIS GDI

Type	Editor, GDI API
Functionalities	SIDIS GDI provides a GDI API to interface roller benches, wheel alignment machines or filling stations according to ASAM GDI standards. The authoring tool of SIDIS Pro provides an editor to create the test sequences.
ASAM Standards	ASAM GDI

SIDIS MCD-3 D Server

Type	ASAM Runtime Kernel
Functionalities	Server API (3D) interface (.net, COM/DCOM, Java), multi client and remote capable. Interface to SIDIS MVCI is available with performance optimized CIF Interface and PDUAPI. High performance diagnostic kernel incl. time measurement traces. Communication processor supports standard protocols (KWP 2000 on K and CAN), UDS and dedicated OEM protocols.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

SIDIS MVCI

Type	Vehicle communication interface
Functionalities	VCI supports standard protocols like KWP 2000 on K-Line and CAN-Bus, UDS, J1939 and dedicated OEM protocols. ASAM features like asynchronous operation, multilink and multi-client capability are available. Devices with WLAN, RF, USB, LAN and serial interfaces are available.
ASAM Standards	ASAM MCD-3 D

SIDIS Runtime

Type	Runtime component
Functionalities	The SIDIS Pro runtime component executes the tests design and developed with the SIDIS Pro authoring system and takes advantage of the parallel communication to multiple ECUs and GDI components to save cycle time in the production line. The embedded CANalyser, debugging and logging functionality simplifies the validation of the test routines.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D, ASAM GDI

Contact: Mr. Klaus Karpf, Mail:klaus.karpf@siemens.com

Siemens PLM Software

Interleuvenlaan 68
B-3001 Leuven, Belgium

Phone +32 16 384 200
Fax +32 16 384 350

www.plm.automation.siemens.com

Siemens PLM Software is an engineering innovation partner for companies in the automotive, aerospace and other advanced manufacturing industries. Siemens PLM Software enables its customers to get better products faster to market, and to turn superior process efficiency to their strategic competitive advantage. Siemens PLM Software offers a unique combination of virtual simulation software, testing systems, engineering services, process and data management. Siemens PLM Software is committed to openness of its Simulation and Test solutions, based on the support of standards, so as to enable optimal interoperability of Siemens PLM Software solutions with complementary solutions supporting the development processes at its customers.

LMS Test.Lab

Type	Integrated environment for functional performance Testing
Functionalities	LMS Test.Lab is a complete solution for test-based engineering combining high-speed multi-channel data acquisition with a suite of integrated testing, analysis and report generation tools. LMS Test.Lab is designed to make testing more efficient and more convenient for the users. It includes solutions for rotating machinery, structural and acoustic testing and vibration control. Support of the ASAM ODS format is a cornerstone of the LMS Test.Lab application, providing full data compatibility with data originating from other sources than LMS Test.Lab.
ASAM Standards	ASAM ODS

LMS Test.Lab Data Management

Type	Engineering Data Management Solution
Functionalities	The LMS Test.Lab Data Management solution provides an environment for efficient management, sharing and data exchange for both work-in-progress and published NVH test data. LMS Test.Lab Data Management can manage ASAM-ODS data securely, publish data beyond the restricted project team and increase the efficiency of sharing data across the company.
ASAM Standards	ASAM ODS

Contact: Ms. Allison Fassin, Mail: info.lms.plm@siemens.com

Sierra CP Engineering Ltd.

Sandy's Road, Enigma Business Park
WR14 1JJ Malvern, Great Britain

Phone + 44 1684 584850
Fax + 44 1684 573088

www.sierra-cp.com

Offices
US sales@sierra-cp.com
IN sales@sierra-cp.com

Sierra-CP Engineering has over 30 years' experience in providing test equipment solutions, all based on our proprietary CADET V14 Control & Automation package. Our range comprises of engine, powertrain, vehicle and component testing equipment as well as engine combustion air handling systems, emissions sampling, robot drivers, fuel measurement and fuel conditioning solutions. We design and manufacture all of our own solutions and support them globally with locations in UK China, UK, USA, India and Malaysia.

CADET Automation System

Type	Test Bed Automation System
Functionalities	Data acquisition, real time control, test sequencing
ASAM Standards	ASAM MCD-1 CCP

Contact: Mr. Phil Roberts, Mail: pnr@sierra-cp.com

SIMTOOLS GmbH

Werner von Siemens Str. 1
7343 Neutal, Austria

Phone +43 5 9010 29330
Fax +43 5 9010 29331

www.simtools.at

SIMTOOLS GmbH provides tools for developers of distributed control applications. The tools are integrated with the model-based design environment MATLAB/Simulink and support communication standards like FlexRay and CAN. By supporting different workflows the tools provide seamless model-to-code capabilities. Customers include the automotive and other transportation industries as well as research institutions and academia.

SIMBUS

Type	SW-Tool
Functionalities	SIMBUS is a toolbox integrated in the MATLAB/Simulink environment for LIN, CAN/FleyRay rest-bus simulation. The toolbox supports the development of application and/or test functions in Simulink. During execution of the rest-bus system SIMBUS provides synchronoues, real-time access to LIN, CAN and FlexRay directly from the MATLAB/Simulink environment.
ASAM Standards	ASAM MCD-2 NET (FIBEX)

SIMTOOLS/SIMTARGET

Type	SW-Tool
Functionalities	SIMTOOLS/SIMTARGET is a blockset for use with MATLAB/Simulink for the development of FlexRay-based applications. SIMTOOLS cover the whole development process from System-level modelling to ECU-level design, configuration and code generation supporting a seamless transition of Simulink block diagrams to the supported hardware platforms.
ASAM Standards	ASAM MCD-2 NET (FIBEX)

Contact: Mr. Dr. Emmerich Fuchs, Mail: ef@simtools.at

14 Boulevard du Maréchal A. Juin
44100 Nantes, France

Phone + 33 228 236060/ +1 917 727 3020
Fax + 33 240 500601/+1 917 210 4208

www.sodius.com

Offices
US contact@sodius.com

Sodius SAS

Linking, synchronizing or exchanging engineering data are the most needed capabilities today to enhance productivity and collaboration not only between applications but between teams and organizations. Sodius develops data synchronization products and services that allow people and systems to work together to deliver projects across disciplines, teams, and organizations. In order to ensure high quality on-time deliverables, Sodius supports both systems and software design teams with dedicated services and solutions for requirements management, architecture, modeling and ALM/PLM domains.

Contact: Mr. Thomas Capelle, Mail: tcapelle@sodius.com

Richard-Reitzner-Allee 6
85540 Haar, Germany

Phone+49 89 45656439 420
Fax+49 89 45656499 499

www.softing.com

Offices
US automotive.usa@softing.com

Softing Automotive Electronics GmbH

Softing provides products covering the entire life cycle of an ECU. Its range includes the Diagnostic Tool Set (DTS) product family with authoring, flash and analysis tools as well as ODX runtime systems. Data logger for the vehicle bus systems and interfaces enable symbolic access to the ECUs. Furthermore, Softing offers customer-specific solutions for every stage of the ECU life cycle, especially solutions for development, test, production or after sales applications.

DTS Automation

Type	Easy-to-use API with ODX V2.0.1/2.2 run-time system
Functionalities	Easy-to-use API to handle diagnostics in automation environments via ODX databases. Available as COM, OPC, C++ or LabVIEW API supported hardware: EDIC family, samtec HS-family, Softing CAN HW family, DCDI, Kvaser CAN HW, Vector CAN HW, D-PDU-API compliant interfaces, SAE J2534 compliant interfaces
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

DTS COS

Type	ASAM MCD-3/MVCI server with D-PDU API MCD-3D v2.0.1 (for ODX 2.0.1) and 3.0 (for ODX2.0.1 and 2.2) available
Functionalities	Run-time system for diagnostics, flash programming, measurement, variant coding, OBD, etc. supported hardware: EDIC family, samtec HS-family, Softing CAN HW family, DCDI, Kvaser CAN HW, Vector CAN HW, D-PDU-API compliant interfaces, SAE J2534 compliant interfaces
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

DTS Flash

Type	Flash programming
Functionalities	Flash programming based on ODX v2.0.2 and 2.2 files, Motorola S-record or Intel Hex input files also supported One button solution for end-users and step-wise execution for developing
ASAM Standards	ASAM MCD-2 D (ODX)

DTS Monaco

Type	Engineering Tool (measurement and diagnostics)
Functionalities	Full feature engineering tool with application oriented user interfaces for diagnostics, flash programming, measurement, variant coding, OBD, bus


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Automotive Electronics GmbH

	node emulation, communication analysis, etc. supported hardware: EDIC family, Softing CAN HW family, DCDI, CANlink/2, Kvaser CAN HW, Vector CAN HW, D-PDU-API compliant interfaces, SAE J2534 compliant interfaces
ASAM Standards	ASAM MCD-2 D (ODX)

DTS OBD

Type	OBD test and verification
Functionalities	Test of ECU's OBD- starting on scan tool level down to issue analysis on communication level.
ASAM Standards	ASAM MCD-2 D (ODX)

DTS Venice

Type	ODX editor/checker. Available for ODX 2.0.1 and ODX 2.2
Functionalities	Administration of ODX/PDX databases, editing of ECU diagnostics, symbolic and semantical check of databases, export to RTF and PDF, verification of interpretation without ECU possible
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L)

ECU-Test (TestCASE)

Type	Fully featured Test Automation
Functionalities	Test automation for diagnostics and function tests of ECUs; including great variety of test systems which allows overall test, e.g. Softing DTS (ODX/MCD-3D) and EDIABAS, dSPACE HiL, ETAS INCA (A2L), Vector CANoe, Matlab/Simulink, etc. special versions for UDS and ODX testing
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-3

ODX/OTX/MCD-3 training

Type	Training, workshops and consulting on diagnostic related standards
Functionalities	Based on the experience coming from active workgroup participation Softing provides trainings and workshops on ODX, OTX, and ASAM MCD-3, off-the-shelf or tailor-made, on-site or at our training center in Haar/Munich. We also provide consulting on how to use those standards efficiently.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

OTX Server

Type	Run-time interpreter for OTX sequences including ASAM MCD-3D server
Functionalities	Interpreter for OTX sequences based on ODXv2.0.1/2.2 diagnostic data, based on fully featured ASAM MCD-3D/MVCI-server, provides easy-to-use API allowing efficient integration into any diagnostic tool
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

OTX Studio

Type	Comfortable editor for OTX sequences including ASAM MCD-3D server
Functionalities	Easy-to-use authoring system according to ISO 13209, based on Softing D-Server DTS COS and ODX data, specification view (flow charts) and implementation view (line-based), debugging, online-change of code while debugging, reporting. Many supplements to the standard, e.g. DLL access, file access, GUI library
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

Softing TDX

Type	Workshop tester based on ODX/OTX/ASAM MCD-3D
Functionalities	Fully configurable workshop tester for all diagnostic functions incl. handling of error memory, measurement, flash programming and guided functions/ diagnostics
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-3 D

Contact: Mr. Markus Steffelbauer, Mail: markus.steffelbauer@softing.com

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Sontheim Industrie Elektronik GmbH

Georg-Krug-Str. 2
87437 Kempten, Germany

Phone + 49 831 575900-0 0
Fax + 49 831 575900-73 72

www.s-i-e.de

Offices
DE info@s-i-e.de
US info-us@s-i-e.de

As a manufacturer of high performance and quality hard- and software products Sontheim Industrie Elektronik GmbH provides a broad range of high-tech products for automation and automotive industry and is also specialized in protocol stacks like ISO15765 (KWP2000 on CAN), J1939 and RAW-CAN, which can be used by the M.D.T to develop diagnostic applications.

CANexplorer 4

Type	CAN-Bus monitoring, logging and analyzing software
Functionalities	Modular, efficient, intuitive - the CANexplorer 4 is a completely new developed fieldbus analyzing software which reflects years of know-how regarding the work with CAN-networks within complex machines and vehicles. This new generation features many more functions combined with an intuitive and flexible handling. The CANexplorer provides the complete range of function modules for data acquisition, data processing, data conversion, data logging and data visualization.
ASAM Standards	ASAM MCD-2 D (ODX)

CANfox

Type	CAN-to-USB interface
Functionalities	The CANfox is a compact CANto-USB interface with a 32-Bit micro controller. It provides 1 opto isolated CAN-channel and 1 RS232 channel. With its compact design and providing high performance it‘s perfect for mobile use. The multithread software interface SiECA132 with demo application for own applications is included.
ASAM Standards	ASAM MCD-2 D (ODX)

CANUSB

Type	CAN-to-USB interface
Functionalities	The CANUSB is a robust CAN-to-USB interface even for rough use and provides up to 2 opto isolated CAN-channels with additional features like ErrorFrame detection and analogue level measurement of the CAN-level. The multithread software interface SiECA132 with demo application for own applications is included.
ASAM Standards	ASAM MCD-2 D (ODX)

COMhawk

Type	ECU, Telematics Module, Diagnostic Module, CAN-to-Ethernet Gateway, CAN-to-Wi-Fi Gateway
Functionalities	Equipped with a 32-bit microcontroller and based on a MicroC/OS-II or Linux operating systems, COMhawk™ offers standard interfaces such as CAN and Ethernet as well as a Wi-Fi interface and optional digital in- and outputs. The on-board device has a robust design of IP67k and is

	capable of operating in harsh environments including exposure to dust, extreme temperatures, shock, vibration, and high pressure water or steam jets. A webserver is also integrated.
ASAM Standards	ASAM MCD-2 D (ODX)

M.D.T. Modular Diagnostic Tool

Type	Development Tool
Functionalities	The M.D.T. is a tool for the development of diagnostic applications for the automotive industry by using the latest technology. The multithread based systems provide the possibility to develop diagnostic application without coding by using multiple protocol stacks like ISO15765 (KWP 2000 on CAN), RAW-CAN, J1939 and ISO11783 (ISOBUS).
ASAM Standards	ASAM MCD-2 D (ODX)

ODX-Editor

Type	Development Tool
Functionalities	In addition to the M.D.T. the ODX-Editor provides the user an easy way for editing existing or the creation of new ODX-Data by using a graphical user interface. It cares to observe the rules for creating valid data, tests existing databases and provides help functions during the editing.
ASAM Standards	ASAM MCD-2 D (ODX)

Contact: Mr. Daniel Magnus, Mail: daniel.magnus@s-i-e.de

Soundtec GmbH

Bunsenstr. 9 c
37073 Göttingen, Germany

Phone + 49 551 548580 50
Fax + 49 551 5485828 28

www.soundtec.eu

High-quality measurement and analysis systems for acoustics and vibration (software and hardware). Solutions for acoustical development, design and testing of machines and components. Customers: automotive, shipbuilding, home appliances manufacturers, aerospace, machinery manufacturers

si++Workbench

Type	si++Workbench is a Software tool for acoustic and vibration test, Analysis and Documentation. All steps of your daily work are done elegantly with this comfortable tool.
Functionalities	Measure your subject of interest (sound, vibration). Handle the list of all your records. Listen to and cut your recordings if needed. Analyze with one or many of the long list of available functions. Design your documents. Print out or send your reports.
ASAM Standards	ASAM ODS

siVision

Type	siVision is a software tool for integrated analysis, filtering and rating of sound. Using this sound simulation presents the user with specific objectives (in dB) for optimizing the noise characteristics of a real component, machine, or vehicle. siVision on LivePad is a compact complete system (measuring instrument, computer hardware and software) with 4 ICP inputs and a CAN bus interface, which can be operated intuitively via an integrated tablet PC. The system is ideal for mobile work, and can be used directly as a test system for applications involving automatic sound testing.

Functionalities	siVision optically displays all sound components perceived by the human ear and provides filters to reduce, eliminate, or enhance individual sound components. Real time analysis of sound and vibration - Troubleshooting components and machines - Sound optimization - Interactive and intuitive simulation of target sounds - Objective and subjective rating of sounds and target sounds - Acoustic source identification on the object - End of line testing in production environment
ASAM Standards	ASAM ODS

Contact: Mr. Ralph Schwerdtfeger, Mail: info@soundtec.eu

STIEGELE Datensysteme GmbH

The STIEGELE Datensysteme GmbH is specialized in sophisticated hard- and software solutions for data acquisition, processing and test rig control. The company, located in Rothenburg ob der Tauber / Germany, was founded in 1984. The software supports standard data acquisition hardware from all major manufacturers and common data formats.

MGraph

Type	Software
Functionalities	Data analysis and presentation
ASAM Standards	ASAM ODS

MLab

Type	Software
Functionalities	Data acquisition and test rig control
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-1 CCP, ASAM MCD-2 NET (FIBEX)

Contact: Mr. Max Staudacher, Mail: max.staudacher@stiegele.eu

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Synchrotek d.o.o.

Synchrotek is using the array of in-house built applications and software modules providing almost automatic transfer from model based solutions to prototyping hardware, so the focus is on flexible and cost effective solutions.

Contact: Mr. Nikola Bulatovic, Mail: info@synchrotek.com

TESIS DYNAware Techn. Simulation Dynamischer Systeme GmbH

OEMs and suppliers throughout the world rely on simulation solutions from TESIS DYNAware. With over 20 years of experience in the Automotive Industry, customers can benefit from simulation expertise in the development of new engine and drivetrain concepts as well as for vehicle dynamics control systems, complete vehicle simulation, energy management and driver assistance systems.

SOUNDTEC

STIEGELE Datensysteme GmbH

Conrad-Eberhard-Str. 5
91541 Rothenburg o.d.T., Germany

Phone + 49 9861 9488 0
Fax + 49 9861 9488 49

www.stiegele.eu

Synchrotek Science on board

Radoslava Grujica 30/2
11118 Belgrade, Serbia

Phone + 381 11 6555400
Fax + 381 11 6555404

www.synchrotek.com

TESIS DYNAware

Baierbrunner Str. 15
81379 München, Germany

Phone + 49 89 747377 0
Fax + 49 89 747377 99

www.tesis-dynaware.com

DYNA4

Type	Automotive Simulation Software
Functionalities	Open and flexible simulation framework with model handling, test automation and result management, extensive real-time model library for vehicle dynamics, engine dynamics, advanced powertrains and driver assistance systems
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM HIL, ASAM XIL, ASAM XIL-MA, ASAM MDF

veDYNA

Type	Vehicle Dynamics Simulation Software
Functionalities	Vehicle dynamics simulation model for real-time simulation of passenger cars, trucks and trailers with conventional, hybrid or electric powertrains, tools for suspension analysis and
ASAM Standards	ASAM HIL, ASAM XIL, ASAM XIL-MA, ASAM MDF

Contact: Mr. Maximilian Chucholowski, Mail: m.chucholowski@tesis.de

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TOYO Corporation

1-6, Yaesu 1-chome, Chuo-ku
103-8284 Tokyo, Japan

Phone + 81 3 3279 0771
Fax + 81 3 5205 2030

www.toyo.co.jp/car

TOYO Corporation is an independent Technical trading company in Japan. We see ourselves as the TECHNOLOGY INTERFACE between European/American and Japanese/Asian test and measurement engineering companies since 60 years. TOYO Corporation also offers system integration, localization and aftersales services in data measurement, data analysis to data management to Japanese Automotive Engineers in any fields.

CRONOS-compact/-flex

Type	Universal data acquisition system for in-vehicle tests and test-beds
Functionalities	imc CRONOS-compact is a networkable data acquisition system with up to 512ch for analog and digital buses (like CAN/CCP, LIN etc.) measurement in any environment. CRONOS-Compact can be connected with any test-bed controller and MCD tools via XCP on Ethernet by using A2L files.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-2 MC (ASAP2/A2L)

imc-CANSAS

Type	CAN-bus based Measurement & Analysis Modules
Functionalities	High-performance CAN-bus based measurement modules for applications in test stands, in-vehicle and industrial environments. imc CANSAS is a revolutionary concept for the decentralized capture of physical measurement data.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

imc-FAMOS

Type	Comprehensive data processing & signal analysis framework
Functionalities	imc FAMOS provides you with the versatile software tools necessary to visualize and analyze your data, automating routine and complex tasks, from data import to test report. imc-FAMOS can be also used as ASAM-ODS Client by using ODS Browser functionality.
ASAM Standards	ASAM ODS

TOYO Corporation

PAK/edp

Type	Dynamic Data Measurement and Analysis system / Web-based engineering data portal
Functionalities	Data acquisition of fast, slow of physical measurements and buses measurements. Data analysis with innovative technologies. Highly effective Engineering Data Management
ASAM Standards	ASAM ODS

Peak ODS Server - ASAM-ODS tools

Type	Server and clients for measurement data management with openMDM framework
Functionalities	Consultation for the Process and Methodology in any Test & Measurement fields, Support services and Training for Japanese engineers who is considering improving Measurement Data Management.
ASAM Standards	ASAM ODS

TrackReport

Type	Signal Analysis & Automated Report Generation Software
Functionalities	TrackReport offers a full data visualization and analysis environment, where interactivity and automation help creating simulation or test reports. Configurable report models handle data post-processing algorithms as well as the graphical setup. TrackReport can be also used as ASAM-ODS Client tool.
ASAM Standards	ASAM ODS

Contact: Mr. Haruo Fukuro, Mail: fukuro@toyo.co.jp

TraceTronic GmbH

tracetronic

Stuttgarter Str. 3
01189 Dresden, Germany

Phone + 49 351 205768-0 0
Fax + 49 351 205768-999 99

www.tracetronic.de

Since its foundation as a spin-off from Dresden University of Technology, TraceTronic has been working with a large number of strong partners throughout the automotive industry. Our highly competent and interdisciplinary team of engineers offers a wide range of services in the field of software applications for validation of embedded systems. Due to our close relationship with customers and the years of experience and scientific research, we have the expertise to guarantee powerful and customized products and services.

ECU-TEST

Type	Test automation software
Functionalities	ECU-TEST is an integrated test automation tool used for specification, implementation, execution, and documentation of test cases. This software executes regression tests which are essential for validating complex technical products such as electronic control units (ECUs). ECU-TEST can be applied during product development as well as during quality control of production itself.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MCD-3

Contact: Mr. Rocco Deutschmann, Mail: rocco.deutschmann@tracetronic.de

Schoenbrunner Str. 7
1040 Wien, Austria

Phone + 43 1 585 6538-5049
Fax + 43 1 585 6538-5090

www.tttech-automotive.com

Offices
AT office@tttech-automotive.com
DE office@tttech-automotive.com
JP office@tttech.jp
KR korea@tttech.com

TTTech Automotive GmbH

TTTech Automotive, a subsidiary of TTTech Computertechnik AG, provides reliable control unit platforms and software solutions offering highest safety classification in accordance with ISO 26262/ASIL D. The modular, certified hardware and software solutions are used for serial production in the field of control and monitoring of electric and hybrid propulsion systems as well as for vehicle dynamics and driver assistance. To validate the vehicle functions, the product range is completed by intelligent data loggers and test equipment for networked systems. TTTech Automotive is a premium member of the FlexRay and AUTOSAR consortia and endorses these open standards for automotive electronic architectures with its products and solutions. Further information on the company and products is available at www.tttech-automotive.com and products@tttech-automotive.com.

TTX-Connexion

Type	Intelligent gateway for signal manipulation
Functionalities	4-Way-Gateway (2 x CAN, 2 x FlexRay); signal routing and manipulation; Datalogging on CF card; Comfortable network configuration via FIBEX, CANdb, and AUTOSAR TL (V3.0); Online-viewing and analyzing with TTXAnalyze; Stand alone in vehicle operation
ASAM Standards	ASAM MCD-2 NET (FIBEX)

TTX-DataLogger

Type	Comprehensive Recording & Analysis of the entire vehicle Network
Functionalities	Simultaneous, extensive data logging with a central time stamp; Configurable power management Filters, triggers, pre-analysis; Open data format; Integrated CCP/XCP master; Freely programmable; Wake-up recording
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

TTX-Disturbance Node

Type	Reproducible failure injection for FlexRay
Functionalities	synchronous and asynchronous disturbances; global and local disturbances; Disturbances on channel A and/or channel B; Configurable, triggerable disturbances (incl. 60 test cases); Termination resistor and short-circuit tests; Sending of disturbed frames; Can be automated
ASAM Standards	ASAM MCD-2 NET (FIBEX)

TTX-Optical Link

Type	Optical decoupling for FlexRay
Functionalities	Minimal effect on FlexRay time response - fulfilling the requirements of ISO 11452-2 and CISPR 25
ASAM Standards	ASAM MCD-2 NET (FIBEX)

Contact: Mr. Marc Lang, Mail: marc.lang@tttech-automotive.com

Vector Informatik GmbH

Ingersheimer Str. 24
70499 Stuttgart, Germany

Phone + 49 711 80670 0
Fax + 49 711 80670 111

www.vector.com

Offices
US info@vector-cantech.com
JP info@vector-japan.co.jp
FR information@vector-france.fr
SE info@vector-scandinavia.com
KR info@vector-korea.com

Vector is the leading manufacturer of software tools and software components for networking of electronic systems based on CAN, LIN, FlexRay, Ethernet, WLAN and MOST as well as multiple CAN based protocols. The Vector know-how is reflected in a wide range of tools as well as in integrated consulting services with software and systems engineering. Workshops and seminars complete the manifold training program. Customers from the automotive engineering, the commercial vehicle, aerospace, transportation and control technologies around the world trust in the solutions and products from the independently-owned Vector Group.

ASAP2 Editor

Type	Editor for MCD-2MC (ASAP2) files
Functionalities	Comfortable editor for creating, modifying and updating MCD-2MC description files (*A2L) exploiting the corresponding linker map file.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

ASAP2 Lib

Functionalities	The ASAP2 Lib is a function library for reading ASAP2 files of all released versions, including the current V1.61. The library was developed for the C programming language and can be embedded in applications. On demand Vector offers development of customized A2L-converters.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

ASAP2 Tool-Set

Type	Updating and merging MCD-2MC (ASAP2) files
Functionalities	The ASAP2 Updater updates the address and data type information of an ASAP2 file using the linker map file. The ASAP2 Merger merges several ASAP2 files to a common ASAP2 file.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

CANalyzer

Type	Tool for stimulation and analysis of networks
Functionalities	CANalyzer is the universal software analysis tool for ECU networks and distributed systems. CANalyzer makes it easy to observe, analyze, and supplement data traffic in CAN, LIN, MOST, or FlexRay systems. With powerful functions and user-programmability, all needs are covered from simple network analysis to advanced troubleshooting of complex problems. CANalyzer support the developer in implementing the diagnostic functionality of an ECU.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-2 NET (FIBEX)

CANape

Type	Measurement, calibration and diagnostic system
Functionalities	Time-synchronous acquisition of measurement data via CCP or XCP from CAN, LIN, FlexRay, MOST or external test equipment. Environment recognition by video, audio or GPS. Convenient real-time calibration by CCP or XCP. Seamlessly integrated diagnostics by KWP2000 and UDS. Convenient management of calibration data.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MCD-3, ASAM MDF

CANdelaStudio

Type	Authoring tool for diagnostic specification
Functionalities	Specify ECU diagnostic services and data in a user-friendly way. This information can be used for test system data supply, ECU auto-code and ECU software validation. Import/export from/to many different formats, including ODX (MCD-2D). A template concept ensures a consistent development process and allows diagnostic data to be reused in different OEM-specific protocols. CANdelaStudio supports several standards like KWP2000, UDS, WWH-OBD, J1939, DoIP, FlexRay. A quick learning curve is guaranteed, not just for diagnostic experts. Data consistency is ensured and enhances product quality.
ASAM Standards	ASAM MCD-2 D (ODX)

CANoe

Type	Tool for test, simulation, diagnostic and analysis of networks
Functionalities	CANoe is the comprehensive software tool for development, test and analysis of entire ECU networks and individual ECUs. It supports you throughout the entire development process. Its versatile functions and configuration options are used worldwide by OEMs and suppliers. The open design makes CANoe the first choice for ECU development for combustion engines and projects related to electrification of the powertrain.
ASAM Standards	ASAM XIL, ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

CANoe.DiVa

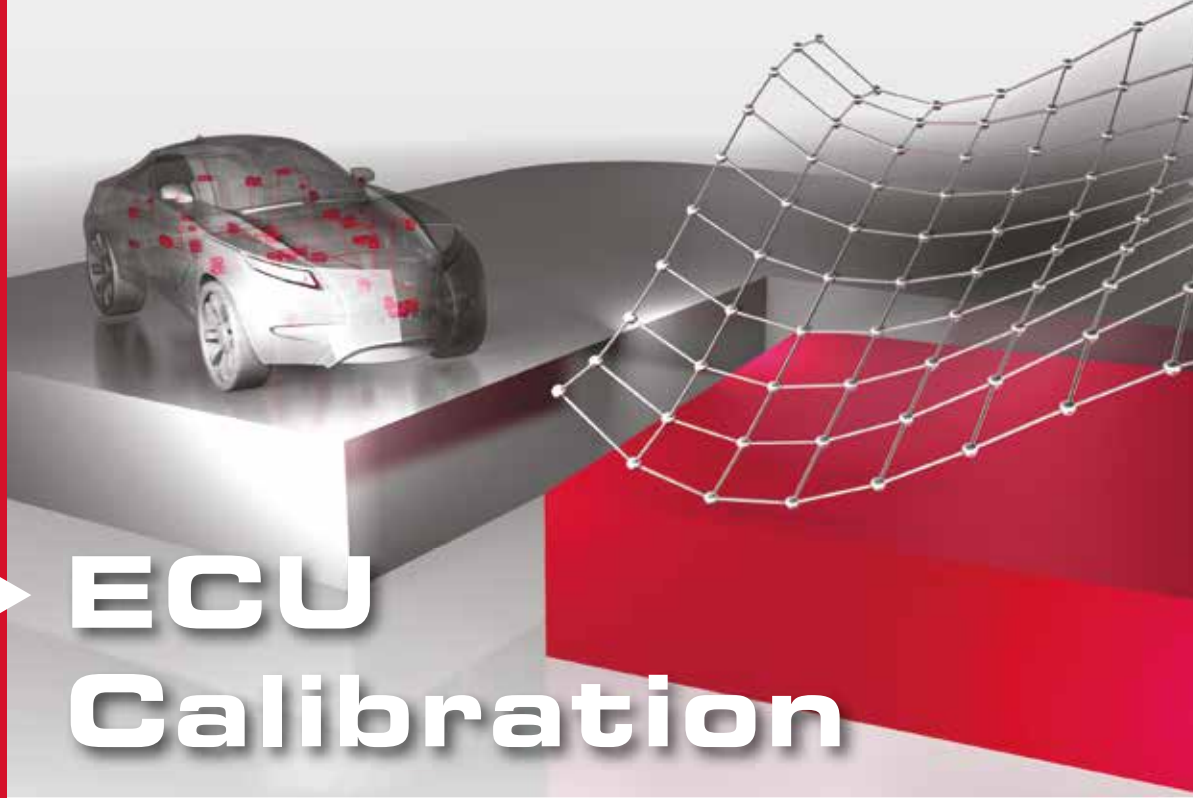
Type	Tool for Automated Testing of Diagnostic Protocol Implementation and Integration in ECUs
Functionalities	Automatic generation of test cases with comprehensive test coverage based on ECU diagnostic descriptions in ODX or CANdela format. Test cases are executed, an extensive test report is generated. According to a case study, savings of effort by a factor of 4 up to 20 are achieved.
ASAM Standards	ASAM MCD-2 D (ODX)

CDM Studio

Type	Calibration Data Management
Functionalities	CDM Studio is an efficient tool for editing parameter set files. It is easily used to display, compare and edit parameters created in ECU calibration. When solving complex tasks, filters are used to reduce the number of parameters shown on the screen. In addition to calibrating parameter values you can take values from different files and merge them to create new version levels. In using CDM Studio, you retain an overview of your work packages, reliably track parameter changes and manage data levels responsibly. Since all relevant file formats of the automotive industry are supported, it does not matter which measurement and calibration tool is used to generate the parameter files.
ASAM Standards	ASAM CDF, ASAM MCD-2 MC (ASAP2/A2L)

Consulting & Engineering Services for ODX

Type	Vector gives you the best conditions for implementing your requirements. The knowledge of our experienced employees is your advantage in coming up with efficient and customer specific diagnostic solutions.
Functionalities	Vector can provide you with both technical consultation and adaptation or customization of Vector tools in service projects. Our employees are very familiar with many OEM-specific data formats, the ASAM and ISO stan-



ECU Calibration

Your efficient all-round solution for measurement, calibration and diagnostics

Universal tool support simplifies your calibration of ECUs. The versatile CANape tool lets you cover all application cases effortlessly:

- Quickly and reliably capture measured data from various sources – synchronous and time-precise. Whether via CCP, XCP-on-CAN/FlexRay/Ethernet or from external test equipment
- Conveniently calibrate the parameters of your ECU algorithms, either online in the ECU or offline in the Hex file
- Easily manage large amounts of calibration data – with full traceability at all times – even on large project teams
- Simplify your tool environment by seamlessly integrated diagnostic services and flash solutions
- Benefit from a universal tool chain with extensive rapid prototyping capabilities and MATLAB/Simulink integration

Vector supports you from functional development to production-ready ECU, in the laboratory, on the test bench and during driving trials.

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	dards and underlying processes. Our services are: Optimization of existing diagnostic processes, Migrations of master data to ODX, consultation on the implementation/integration of ODX in existing diagnostic development processes, definition and implementation of authoring guidelines, OEM-specific ODX Techdays
ASAM Standards	ASAM MCD-2 D (ODX)

DaVinci Configurator Pro

Type	Configuration of AUTOSAR basic software
Functionalities	DaVinci Configurator Pro is the configuration tool for MICROSAR basic software (BSW) and runtime environment (RTE). It masters the complete ECU configuration workflow and supports multiple input formats such as AUTOSAR System Description or the ASAM file formats FIBEX (description for CAN and FlexRay networks) and ODX (description of diagnostic implementation). DaVinci Configurator Pro exports A2L files that describes the measurement and calibration parameters of MICROSAR BSW and RTE.
ASAM Standards	ASAM MCD-2 D (ODX), ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX)

FIBEX Explorer pro

Type	Tool for viewing, editing and creating FIBEX XML files
Functionalities	View, edit and create FIBEX files for FlexRay including manufacturer extensions in a user-friendly way without detailed knowledge of the XML-based file format. The tool provides loss-less editing functions for FIBEX files.
ASAM Standards	ASAM MCD-2 NET (FIBEX)

GL Logger Family

Type	Data logger for test fleet operators and test benches
Functionalities	Logging of CAN, LIN, MOST150, FlexRay networks. Additional logging of analog and digital channels. Support of CCP/XCP on CAN and XCP on FlexRay. Diagnostics via UDS and KWP2000 on CAN.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX), ASAM MCD-2 NET (FIBEX)

Indigo

Type	Vehicle-oriented diagnostic test system
Functionalities	Easy-to-use diagnostic tester to apply diagnostics during system development and vehicle integration. No diagnostic expert knowledge required by users. Self-configuring, use-case driven and vehicle-oriented GUI. Parameterized via ODX and other relevant data formats. Simultaneous support of KWP, UDS and GMW3110. Also support of Diagnostics over-CAN FD and DoIP, as well as OBD (OBD2 or WWH-OBD). Direct overview of vehicle status and vehicle identification data. Additionally Indigo Remote is the remote diagnostics solution that lets you access vehicles directly and interactively from anywhere in the world.
ASAM Standards	ASAM MCD-2 D (ODX)

MDF Validator

Type	Tool for viewing and validating the structure of MDF files
Functionalities	MDF Validator is a freeware tool to validate and analyze the block structure of MDF files (3.x/4.x). It will check the loaded MDF file and display

format errors and violations to the specification that disallow loading the file in Vector tools. Unusual or unsupported features are indicated as warnings. MDF Validator also shows the structure of the MDF blocks that contain the (meta) information about the measurement data, which helps exploring the file content and understanding the MDF format. Please note: MDF Validator is NOT able to display the measurement data itself, e.g. as a graphic curve representation. Use Vector CANgraph instead.

ASAM Standards: ASAM MDF

MDF4 Lib

Type: Function library for reading MDF3 and MDF4 files

Functionalities: MDF4 Lib is a powerful function library you can use to sort MDF files and read them in your own applications. Along with the widely used MDF3 format, the new ASAM-standardized MDF4 format is also supported. The library offers a convenient C++ interface for easy access to signal data and meta information in a MDF file, independent of the specific MDF version (3.x/4.x).

ASAM Standards: ASAM MDF

MICROSAR

Type: AUTOSAR basic software which includes an implementation of the XCP Slave

Functionalities: The package MICROSAR XCP supports XCP communication with an XCP master on various communication topologies such as CAN, CAN-FD, LIN, FlexRay or Ethernet. The runtime environment MICROSAR RTE supports software components with calibration ports allowing access to calibration data. MICROSAR RTE manages calibration data access during offline and online calibration; the latter supports different data access strategies like initialized RAM and Single- and Double Pointered. Configuration (e.g. transport layer parameters or XCP events) is done in the configuration and generation tool DaVinci Configurator Pro.

ASAM Standards: ASAM MCD-1 XCP

ODXStudio

Type: Authoring Tool for diagnostic data in ODX format

Functionalities: Easy-to-operate user-oriented authoring tool for diagnostic data in ODX format. Standard conformant - perfect round-trip functionality by use of ODX as internal data format. Quick loading, editing and saving of even very large sets of ODX data (>> 100MB). Optimal scalability: From individual ECU to entire vehicle or platform. Extensive features to support OEM-specific authoring guidelines. Full coverage of all ODX categories ODX-D, ODX-C, ODX-V, ODX-F, ODX-E, ODX-FD

ASAM Standards: ASAM MCD-2 D (ODX)

Training for ODX

Type: Training

Functionalities: Training for ODX, with exercises

ASAM Standards: ASAM MCD-2 D (ODX)

vCDM

Type: Collaboration platform for calibrators

Functionalities: vCDM is a collaboration platform to exchange data within and among globally distributed calibration teams. It provides sophisticated functions to support an iterative calibration approach. The database founded tool collects, merges, transforms and distributes calibration data. Many formats

	are supported (DCM, CDF 2.0, CSV, PaCo, CANape PAR, Intel-HEX and Motorola S-Record). The physical calibration data is tracked within a data warehouse. Reports to track calibration maturity are available. Analysis functions and APIs can be used to benefit from the collected intellectual property.
ASAM Standards	ASAM CDF, ASAM MCD-2 MC (ASAP2/A2L)

vFlash

Type	(Re-)Programming ECUs over CAN, CAN FD, FlexRay, LIN or Ethernet (DoIP)
Functionalities	vFlash is a very easy-to-use tool for programming one or more ECUs via CAN, CAN FD, FlexRay, LIN or Ethernet (DoIP). It provides ECU programming based on direct “native” flashing in Intel hex, Motorola-S and binary format as well as flash programming based on ODX-F. Because of its flexible approach, vFlash can support different flash specifications of a wide variety of automotive OEMs without requiring modifications by the end user. The edition vFlash Station allows additionally the simultaneous flashing of up to 8 ECUs each on a separate communication channel.
ASAM Standards	ASAM MCD-2 D (ODX)

vSignalyzer

Type	Display, Evaluate and Document Measurement Data
Functionalities	vSignalyzer is a convenient tool for efficiently evaluating measurement data of all types. It gives you extensive options for visualizing the data as well as functions for manual and automated analysis and reporting. Measurement data acquired in network development, analysis and ECU calibration may be read-in from various file formats.
ASAM Standards	ASAM MDF

VX1000

Type	ECU Interface
Functionalities	The VX1000 System is a scalable solution with top performance for your measurement and calibration tasks. It can be used in the vehicle – both in the interior and in the engine compartment –, on test benches and in the laboratory. The VX1000 base module is connected to a PC over XCP on Ethernet. Overview of Advantages: very small adapter (POD) for the ECU interface, high measurement data throughput of up to 30 Mbyte/s, 80000 samples/s, function bypassing with very short latency times. VX1000 supports all features for Engine Management ECUs like coldstart, page switching …
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L)

XCP Professional

Type	Implementation of the XCP Slave
Functionalities	Implementation of an XCP slave for non-AUTOSAR ECUs using the Vector CANbedded stack. Supporting CAN and LIN network topologies. Configuration (e.g. transport layer parameters or events) is done in the configuration and generation tool GENy
ASAM Standards	ASAM MCD-1 XCP

Contact: Mr. Alfred Kless, Mail: info@vector.com

ViGEM GmbH

Haid-und-Neu-Str. 7
76131 Karlsruhe, Germany

Phone + 49 721 627394 00
Fax + 49 721 627394 11

www.vigem.de

ViGEM is focused on the development and production of innovative test tools for the automotive industry. Our embedded systems offer impressive levels of performance, comfort, and reliability. E.g. ViGEM CCA car communication analyser products enable to record automotive buses and Gigabit Ethernet at continuous data rates up to 4Gbit/s and offer up to 4TB removable memory.

CCA 5001

Type	Car Communication Analyser, data logger, test tool
Functionalities	The CCA 5001 is a data logger for multimedia, infotainment or component development, such as ECU specific test scenarios (chassis, powertrain, comfort, etc.). The CCA 5001 offers mobile, continuous and reliable data recording at 100% bus load. Small dimensioned but at a full range of services the CCA 5001 enables continuous and lossless data recording at data rates up to 300 Mbit/s.
ASAM Standards	ASAM MCD-1 XCP

CCA 7001

Type	Car Communication Analyser, modular data logger, test tool
Functionalities	The CCA 7001 is a modular data logger for analysis and validation of automotive networks and their components. Type and number of buses and interfaces can be adapted by selecting from various plug-in capture units. The CCA 7001 records data at rates of max. 1 Gbit/s. The data is stored on an internal SSD.
ASAM Standards	ASAM MCD-1 XCP

CCA 9002

Type	Car Communication Analyser, high performance data logger, test tool
Functionalities	The CCA 9002 is a high performance data logger for analysis and validation purposes with special regard to advanced driver assistance system, e-mobility, infotainment, and eAVB applications. It offers continuous or event based data recording at data rates up to 4 Gbit/s. The data is stored on 4 TB exchangeable data storage modules (SSD in RAID). The system configuration is modular, i.e. by adding plug-in capture units you can adapt type as well as number of buses and interfaces.
ASAM Standards	ASAM MCD-1 XCP

Contact: Mr. Peter Blume, Mail: peter.blume@vigem.de

An der Schergenbreite 1
93059 Regensburg, Germany

Phone +49 9947 9040004
Fax +49 941 49082 19

www.visu-it.com

Visu-IT! GmbH

Visu-IT! supplies high quality tools for the ECU function and software development of electronic control units. Main objective is to ensure and maintain data consistency in the whole development process - that means both in the system-/ function-development and in the software-development. We also offer development and engineering services in the automotive area.

ASAM MCD-2MC File Parser

Type	ASAP2 Parser (Software Component)
Functionalities	High performance A2L File Parser. Highlights: generic parser, supports all ASAP2 keys, full support of AML, provides both a COM and a .NET interface.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

ASAP2Toolkit

Type	ASAP2 Editor & Tools
Functionalities	The Visu-IT! ASAP2Toolkit is a standalone application to create, import, merge and update “ASAM MCD 2MC” description files (*.a2l). The ASAP-2Toolkit contains an easy to use and intuitive ASAP2 editor, provides an automatic address update and enables the user to use standard development process files “*.i3e” (IEEE-695) and “*.elf” (ELF-DWARF) to generate an a2l description file automatically.
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L)

Automotive Data Dictionary (ADD)

Type	Global data dictionary for ECU variables
Functionalities	The Automotive Data Dictionary (ADD) represents a global data dictionary for all ECU labels/variables used in a company/organisation. The single source concept of ADD eases the handling and management of data declarations over all projects. Due to the (company-wide) availability and uniqueness of these labels, ADD allows a continuous and consistent data declaration during the whole development process.
ASAM Standards	ASAM MDX

Data Declaration System (DDS)

Type	ECU SW Development Environment
Functionalities	DDS represents a central repository for all ECU variable declarations and thereby ensures consistency between your ECU source code and your ASAP2 description file. Interfaces: ANSI-C Export: Address Import (IEEE 695, ELF/DWARF), ASAP2 Import & Export, XML Export & Import, Interface to autocoding tools
ASAM Standards	ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 D (ODX), ASAM MDX

FunDoc

Type	Automated function documentation of simulation models
Functionalities	The objective of the Visu-IT! FunDoc tool is to ease the documentation process of simulation models. At this junction it is designed as a first-step tool in your documentation process chain. FunDoc is able to connect to several development tools and place the gathered information at user’s disposal for edit or print.
ASAM Standards	ASAM CDF, ASAM MDX, ASAM FSX, ASAM CC

Contact: Mr. Franz Lohberger, Mail: Franz.Lohberger@visu-it.de

Weisang GmbH

Sophie-Kraemer-Str. 13
66386 St. Ingbert, Germany

Phone + 49 6894 92960 0
Fax + 49 6894 92960 26

www.weisang.com

Weisang GmbH is developing software and providing services for technical applications. Weisang's core product FlexPro is a standard software package for analysis and presentation of measurement data and is used worldwide by thousands of engineers, scientists and measurement technology experts in automotive and other industries. FlexPro is the client tool of choice to access data stored on ASAM ODS servers and in ATX files as well as data from various data acquisition systems.

FlexPro

Type	Software
Functionalities	Archiving, analysis and presentation of measurement data.
ASAM Standards	ASAM ODS

Contact: Ms. Judith Digbé, Mail: j.digbe@weisang.com

White Pine Software Technologies, LLC

P.O Box 970824
48197 Ypsilanti, USA

Phone +1 734 858 0327
Fax +1 866 674 4375

www.whitepine-st.com

White Pine is a new company that specializes in engineering data management and analysis solutions and software development services. Our company is developing a variety of useful software tools and products primarily aimed at very large scale, high speed data acquisition, processing and analysis using both ASAM ODS and Big Data technologies.

Contact: Mr. Robert Smith, Mail: robert.smith@whitepine-st.com

Wind Hill Technologies Co., Ltd.

503 Digital Media Building 7
Shangdi Xinxi Road, Haidian District
100085 Beijing, P.R. CHINA

Phone + 86 10 8289 4993
Fax + 86 10 8289 4696

www.windhill.com.cn

Wind Hill Technologies was founded in 2003, the headquarters is located in Beijing where set up its R&D center and factory, and we have branches in Shanghai and in Hong Kong. Our product series include ECU tools, test and measurement, industrial automation, testing equipment and engineering services. At present, our products have been widely used in automobiles, engineering machinery, railway, military, etc.

Visual Analyzer

Type	Network Analysis, Measurement and Calibration Tool
Functionalities	Complete solution for bus communication, data logging, measurement, and calibration via CAN, LIN including J1939, CANopen, CCP and XCP protocol support.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP

Contact: Mr. Dr. Thomas Qiu, Mail: info@windhill.com.cn

Jahnstr. 2 b
76870 Kandel, Germany

Phone +49 7275 9143 100
Fax +49 7275 9143 109

www.x2e.de

X2E GmbH

X2E is a highly innovative and flexible partner in the development of advanced electronic solutions for automotive and aerospace applications. The main products are high performance automotive data loggers for the automotive industry. Additionally X2E provides complex solutions, from development of ECUs to automotive bus analyzing tools. Our high performance multibus data loggers are capable of recording data from several automotive bus systems simultaneously (CAN, LIN, FlexRay, RS232, Analog, MOST, Ethernet, BroadR-Reach) with a 100ns precision timestamp. Furthermore, our product range provides a platform which not only collects data, it is also capable of sending data at any time. The data loggers can be tailored to your requirements because of our flexible slot-concept. X2E supports its customers by equipping them with the products which are tailored to their exact needs and more importantly by developing new innovative solutions for them. With an in-house production facility, X2E can provide the full service range from development to production. Innovation, Quality and Customer Satisfaction is what X2E offers to its customers.

Xoraya 6810 Quad V5

Type	Automotive Bus Data Logger
Functionalities	100ns precise timestamp CAN, LIN, FlexRay, MOST, Ethernet, BroadR-Reach, RS-232, GNlog, DLT, Analog, XCP, CCP, PSI5, Video-Interface
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MDF

Xoraya Connect

Type	Remaining Bus Simulation Platform
Functionalities	CAN, LIN, FlexRay, MOST, Ethernet, RS-232
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP

Xoraya Minilogger

Type	automotive data logger
Functionalities	100ns precise timestamp CAN, LIN, FlexRay, MOST, Ethernet, BroadR-Reach, RS-232, GNlog, DLT, Analog, XCP, CCP, PSI5, Video-Interface
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L), ASAM MCD-2 NET (FIBEX), ASAM MDF

Contact: Mr. Florian Weindel, Mail: florian.weindel@x2e.de

XI-Works

Zettachring 12
70567 Stuttgart, Germany

Phone +49 711 248398 0
Fax +49 711 248398 29

www.xi-works.com

XI-Works provides professional services in the fields of engineering processes, documentation, data management and diagnosis. The firm develops engineering documentation and data management solutions and integrates them into customers' system landscapes. XI-Works offers a range of products and framework solutions that can be used to create such systems.

Advanced XML Editor (Axe) for Eclipse Generic XML Editor

Type	Generic XML Tool
Functionalities	XML-Editing in different views (Plain Text, Tree, CSS, Forms), XML-Checking, Spell Checking, Table Editing, Formula Editing, Image Display, Diffing highly customizable by rich API and Extension Points.
ASAM Standards	ASAM XIL, ASAM CC, ASAM CDF, ASAM Container Catalog, ASAM FSX, ASAM Issue, ASAM MDX, ASAM MSRSW

ATX Consulting Services

Type	Consulting Service
Functionalities	The ATX consulting services deliver concepts and specifications for your specific test environment about question like: • How to use ATX? • How to map your existing test descriptions? • Which tools are needed to work with ATX? • How to generate implementation code out of ATX? • How to structure ATX projects? • How to specify specific profiles for my test use cases? • How to define ATX libraries? • How to create test reports? • How to manage test results? Learn from the ATX specification editor.
ASAM Standards	ASAM XIL, ASAM CC

AXE ATX Workbench

Type	Test Specification Editor
Functionalities	Define and Organize ATX Projects Editing, Checking ATX Files
ASAM Standards	ASAM XIL, ASAM CC, ASAM Container Catalog

AxeEcuDoc Ecu Documentation Suite Editing solution for functional specification based on MSRSW, AE-FSX, AE-MDX, MSRREP, AE-CC and AE-ATX

Type	Documentation System
Functionalities	Editing, Checking, PDF-Publishing for Functional Specification and Test Specification
ASAM Standards	ASAM CC, ASAM CDF, ASAM Container Catalog, ASAM FSX, ASAM MDX, ASAM MSRSW

EcuDoc-Publisher PDF publishing for functional specification.

Type	Documentation System
Functionalities	Checking, PDF-Publishing for Functional Specification
ASAM Standards	ASAM CDF, ASAM MDX, ASAM FSX, ASAM CC

EcuDoc-Publisher Server Web application server for server based PDF publishing and continuous integration of functional specification

Type	Documentation System
Functionalities	Checking, PDF-Publishing for Functional Specification
ASAM Standards	ASAM CDF, ASAM MDX, ASAM FSX, ASAM CC

XIDiff Generic XML differ

Type	Generic XML Tool
Functionalities	Show the differences between XML documents, merge of XML documents.
ASAM Standards	ASAM XIL, ASAM CC, ASAM CDF, ASAM Container Catalog, ASAM FSX, ASAM Issue, ASAM MCD-2 D (ODX), ASAM MCD-2 NET (FIBEX), ASAM MDX, ASAM MSRSW

XMetal-Kit for MSRSW, MDX, Container Catalog, MSRREP and MSRSYS

Type	Documentation System
Functionalities	Editing, Checking, PDF-Publishing
ASAM Standards	ASAM CDF, ASAM MDX, ASAM FSX, ASAM CC

Contact: Mr. Herbert Klein, Mail: info@xi-works.de

Yokogawa Digital Computer Corporation

Shinjuku MIDWEST Bldg, 4-30-3 Yoyogi,
151-0053 Shibuya-ku, Tokyo, Japan

Phone + 81 3 6756 9405
Fax + 81 3 6756 9409

http://www.yokogawa-digital.com

Yokogawa Digital Computer is engaged in designing and development of microcomputer, peripheral system and others to providing consulting and tools that help Japanese and international companies improve the development process for embedded product. We can provide ECU measurement tools, software development environments, ICE, debugger, and CAN/Serial programmer.

NETIMRESS

Type	Programmer (CAN/Serial)
Functionalities	Versatile/high-speed flash on-board programmer for both small production line and large production line that can support both stand-alone and network control.
ASAM Standards	ASAM MCD-1 XCP, ASAM MCD-2 D (ODX)

RAMScope

Type	Data measurement, analysis tool
Functionalities	High-speed monitor tool for the environment that measures synchronously and analyzes RAM in two or more ECU
ASAM Standards	ASAM MCD-3 MC

Contact: Mr. Takashi Aiba, Mail: info-mvi@yokogawa-digital.com

ACADEMICS

Aristotle University

54124 Thessaloniki, Greece

Phone + 30 2310 9960 14
Fax + 30 2310 9960 19

lat.eng.auth.gr/index.htm

Aristotle University of Thessaloniki is the largest university in Greece with more than 90,000 undergraduate and postgraduate students. The Laboratory of Applied Thermodynamics (LAT) belongs to the Energy Division of the Mechanical Engineering Department of Aristotle University. Its educational and research activities cover the following fields:

- Applied Thermodynamics and Combustion
- Internal Combustion Engines and Emissions Control
- Emissions Inventories and Forecasts
- Energy Policy and Renewable Energy Sources

The main focus of the laboratory activities lies on applied as well as basic research, regarding exhaust emissions of Internal Combustion Engines. LAT possesses state-of-the-art equipment and know-how on both testing and simulation methodologies in the field of emissions characterization and after-treatment. LAT provides R&D services in the field of automobile exhaust emissions and after-treatment technology. Having a long tradition in this field, LAT possesses valuable experience in both testing and modelling methodologies to provide high quality services to its industrial partners. The testing services are supported by regularly updated equipment for the measurement and characterization of gaseous and particulate emissions, as well as fuel and fuel additive properties.

The Laboratory has founded Exothermia S.A. (2007) and EMISIA S.A. (2008), two spin-off companies specialized on software engineering for exhaust aftertreatment applications and emission inventorying, emission modelling & impact assessment studies of environmental policies, respectively.

Contact: Prof. Samaras Zissis, Mail: zisis@auth.gr

Brandenburgische Technische Universität Cottbus

Siemens-Halske-Ringe 14
03046 Cottbus, Germany

Phone + 49 355 69 2671
Fax + 49 355 69 2672

www.tu-cottbus.de/

Founded in 1991, Brandenburg University of Technology Cottbus is an internationally accepted, innovation-oriented small university with about 6,750 students and about 1,300 employees. It operates teaching and research on highest international level, with the focus on environment, energy, material, construction as well as information and communication technology and combines internationality with regional respect through teaching and research in a real laboratory. The Chair of Automotive Technologies and Drives is integrated in the Institute of Traffic Engineering (ITE) and treats in research and teaching the basics and applications of the vehicle and drive technology, the motorcycle technology and alternative drives. The research focuses here are particularly in the field of thermal and energy management of vehicle drives (engine and drive train) including implementation and validation of certain measures. Furthermore, there are extensive experiences in the simulation of waste heat utilization concepts and cooling systems as well as in the evaluation of fuel consumption and emission potentials in legal cycles as well as in real-life customer drives.

Contact: Mr. Dirk Goßlau, Mail: gosslau@tu-cottbus.de

Műegyetem rkp. 3.
1111 Budapest, Hungary

Phone + 36 1 463 1044
Fax + 36 1 463 3087

www.kka.bme.hu

Budapest University of Technology and Economy, Dep. of Control and Transport Automation

The Budapest University of Technology and Economics can trace its evolution through several academic institutions, dating back to 1782. With 24000 students and many researchers it is one of the most important research centres in Central Europe. The main research area of the Department of Control and Transport Automation are the control theory and automotive engineering.

Contact: Mr. Szilárd Aradi, Mail: aradi.szilard@mail.bme.hu

Inffeldgasse 21 a
8010 Graz, Austria

Phone + 43 316 873 9001
Fax + 43 316 873 9002

www.v2c2.at

Offices
DE office@v2c2.at (Munich)

Das virtuelle Fahrzeug Forschungsgesellschaft mbH

VIRTUAL VEHICLE is an independent, international platform for research and development of new simulation methods/tools in the automotive and rail industry, enabling faster and more efficient development, early validation of concepts and a multidisciplinary development approach. Fields of research include Vehicle Safety, Thermodynamics, NVH, E/E, Software, System Design and Optimization.

Contact: Mr. Mario Driussi, Mail: mario.driussi@v2c2.at

Fachhochschule Köln
Cologne University of Applied Sciences
Institute of Communications Engineering

Fak. IME-INT Betzdorfer Str. 2
50679 Köln, Germany

Phone + 49 221 8275 0
Fax + 49 221 8275 2473

www.fh-koeln.de

Fachhochschule Köln

CUAS represents a broad range of educational and research activities. With about 17,000 students, half of them in engineering programs, there are many opportunities for automotive and ASAM-related projects, student thesis, and other kinds of cooperation. Faculty members are actively involved in ASAM Project groups and familiar with ASAM standards.

Consulting

Product Type	Consulting
Functionalities	Expert monitoring of projects, analysis, recommendations, advice
ASAM Standards	ASAM ACI, ASAM GDI, ASAM MCD-2 NET (FIBEX), ASAM ODS

Contract research/development

Product Type	Research/development service
Functionalities	Conduct research (also within a project team of universities & companies)
ASAM Standards	ASAM ACI, ASAM GDI, ASAM MCD-2 NET (FIBEX), ASAM ODS

Student internships

Product Type	Internship projects
Functionalities	Provide students opportunities to work on internal projects (also intern.)
ASAM Standards	ASAM ACI, ASAM GDI, ASAM MCD-2 NET (FIBEX), ASAM ODS

Student projects

Product Type	Research/development service
Functionalities	Develop prototypes or evaluate methodologies for implementation
ASAM Standards	ASAM ACI, ASAM GDI, ASAM MCD-2 NET (FIBEX), ASAM ODS

Contact: Mr. Rainer Bartz, Mail: Rainer.Bartz@fh-koeln.de

FH Aachen

FH AACHEN
UNIVERSITY OF APPLIED SCIENCES

Eupener Str. 70
52080 Aachen, Germany

Phone + 49 241 6009 52065

www.fh-aachen.de

The FH Aachen is a major research center in Germany. The competencies of the scientists in our 10 faculties and 7 institutes lie in the future fields of energy, mobility, and life sciences. In addition, outstanding experts in the areas of design, architecture, and civil and mechanical engineering, as well as in economics and logistics, and also in the fields of electrical, information and production technology work at the FH.

Contact: Mr. Klaus Thormann, Mail: thormann@fh-aachen.de

FH Braunschweig / Wolfenbüttel

Ostfalia
University of
Applied Sciences

Salzdahlumer Str. 46/48
38302 Wolfenbüttel, Germany

Phone + 49 5331 939 32130
Fax + 49 5331 939 32132

www.ostfalia.de

University of Applied Science, Department Informatics

XIL - Co-Simulationsbackplane –

Product Type	Werden derzeit überwiegend die einzelnen Entwicklungsschritte mit getrennten Tools abgedeckt, so bietet eine Co-Simulation die Chance, den gesamten Entwicklungsprozess beginnend von der Spezifikation über die Implementierung bis hin zum abschließenden Test mit einer ‚Integrierten Entwicklungsumgebung' abzudecken. Damit einhergehend ergeben sich die Chancen, die Übergänge zwischen den einzelnen Entwicklungsschritten mit weniger Aufwand darzustellen, einmal erstellte Testspezifikationen während des gesamten Entwicklungsprozesses nutzen zu können und den Dokumentationsaufwand entsprechend gering zu halten.	
Functionalities	Co-Simulation von: • C-Code • Ascet • Simulink RTW • Simulink • Blender • DAQ • UML	Key-Feature: • Echtzeitfähig • Anwendung auf PC-Plattform und Prototypenelektronik • XCP zum Messen und Parametrisieren • XCP zum Testen
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 MC (ASAP2/A2L)	

Contact: Mr. Detlef Justen, Mail: d.justen@ostfalial.de

FZI Forschungszentrum Informatik

FZI

Haid-und-Neu-Str. 10 – 14
76131 Karlsruhe, Germany

Phone + 49 721 9654 162
Fax + 49 721 9654 163

www.fzi.de

Forschungszentrum Informatik (FZI) is a non-profit contract research organisation that concentrates its efforts on innovative information technologies for providers of investment and consumer products, production processes and information services. FZI supports the development of innovative applications based on recent but already proven techniques, offering its partners a unique interdisciplinary environment that fosters joint research amongst diverse fields of Informatics, Mechanical and Electrical Engineering.

Contact: Mr. Dr. Martin Hillenbrand, Mail: hillenbrand@fzi.de

Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

Berliner Tor 7
20099 Hamburg, Germany
Phone + 49 40 42875 8420
Fax + 49 40 42875 8619

www.informatik.haw-hamburg.de

Hochschule für Angewandte Wissenschaften Hamburg

With 14,000 students Hamburg University of Applied Sciences is one of the largest of its kind in Germany. Founded in 1970, our roots go back to the 18th century. The CoRE (Communication over Real-time Ethernet) group of the department of computer science researches in the area of future automotive communication infrastructures.

Contact: Mr. Prof. Dr. Franz Korf, Mail: korf@informatik.haw-hamburg.de

Max-Planck-Str. 39
74081 Heilbronn, Germany

Phone +49 7131 504 6685
Fax +49 7131 504 146685

www.hs-heilbronn.de

Hochschule Heilbronn

Heilbronn University ranks amongst the major institutions of Higher Education in the state of Baden-Württemberg with over 8,000 students. It works closely with its partners in business and industry in education and research, e.g. the study program Automotive-Systems-Engineering is sponsored by major companies and offers support and consulting to every interested organisation.

Consulting

Product Type	Consulting
Functionalities	Benefit from the knowledge and the experience of our experts in many fields of automotive technology. We can ensure the success of your projects by a sound and detailed analysis and target-oriented advice.
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 NET (FIBEX)

Research and Development Projects

Product Type	Research and Development
Functionalities	We find solutions to your Research and Development problems in many fields of automotive technology
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 NET (FIBEX)

Contact: Mr. Prof. Dr. Ansgar Meroth, Mail: ansgar.meroth@hs-heilbronn.de

Schneidershof
54293 Trier, Germany

Phone + 49 651 8103 478
Fax + 49 651 820 659

www.fh-trier.de

Hochschule Trier

Hochschule Trier is a University of Applied Sciences with 6000 students. We perform research in Vehicular Systems and Electronics as well as in Energy Efficient e-mobility.

Contact: Mr. Prof. Dr. Matthias Scherer, Mail: scherer@fh-trier.de

Friedrich-List-Platz 1
01069 Dresden, Germany

Phone +49 351 462 2118
Fax +49 351 462 2762

www.htw-dresden.de

HTW Dresden

Dresden University of Applied Sciences (Hochschule für Technik und Wirtschaft Dresden) was founded in 1992. It is the second largest post-secondary educational institution in Dresden, the capital of Saxony. Engineering, economics, design, and 'green' disciplines constitute the four pillars that more than 40 forward-looking diploma, bachelor's, and master's degree programs in civil engineering/architecture, electrical engineering, information technology/mathe-

matics, product design, mechanical and process engineering, and business administration are based upon. These degree programs include a number of subjects that are unique to post-secondary education in Saxony such as agriculture, horticulture, landscape planning and development, environmental monitoring and analysis, geoinformatics and surveying, as well as geoinformatics and cartography. International connections of the various courses and placements abroad are essential characteristics of Dresden University of Applied Sciences' modern approach to teaching, which also train students\' intercultural communication skills to foster an important east-west interface. International teaching and research cooperations and student and university teacher exchanges sponsored by the university help to maintain close contacts with numerous universities and colleges in Europe, Africa, America, Asia, and Australia. State-of-the-art laboratories, the university's globally connected computer network, an extensive library, the language centre, and the industrial placement semester (which is compulsory for every student to acquire professional experience and develop new business contacts) all ensure that studies at the university retain a highly practical dimension. The combination of technology, business, and aesthetics, which are of equal interest to both students and instructors, sets the tone for both the training profile and academic life at the university. With 8 faculties, approximately 170 professors, and more than 5,000 students, the university is large enough to integrate the different disciplines successfully and generate a high synergistic effect. On the other hand, it is still manageable enough to facilitate personal dialogue in individual courses. Music enthusiasts can look forward to performances by either of the university's orchestras, and sports fans will enjoy the school\'s outstanding athletic facilities. In addition to its main function as a centre for teaching, the university is also a centre of applied research and economical development. For example, the \'Vehicle Engineering Research Institute\' is recognised internationally. The Zentrum für angewandte Forschung und Technologie e.V. (ZAFT) (Centre for Applied Research and Technology) has existed since 1998, and the goal of the centre is to unite specialists from nearly every faculty to collaborate on innovative system solutions.

Contact: Mr. Hartmut Fussan, Mail: fussan@htw-dresden.de

Jiangnan University

Jiangnan University, situated in the beautiful city of Wuxi, Jiangsu Province, is one of China's national key "211 Project" universities and functions directly under the supervision of China's Ministry of Education.

Contact: Ms. Dr. Na Tian, Mail: tianna@jiangnan.edu.cn

Lihu Road 1800
214122 Wuxi, P.R. China

Phone + 86 510 85074219

www.jiangnan.edu.cn

RWTH Aachen

The Institute for Automotive Engineering (ika) of RWTH Aachen University is Europe's leading institute in automotive engineering. Starting from the idea to innovative concepts for components and systems up to vehicle prototypes the staff of the institute creates and design the future vehicle. In cooperation with car manufacturers and suppliers the ika is making an acknowledged contribution to help solve current and future global challenges.

Contact: Mr. Christian Sahr, Mail: sahr@ika.rwth-aachen.de

Steinbachstr. 7
52074 Aachen, Germany

Phone +49 241 80 25601
Fax +49 241 80 22147

www.rwth-aachen.de

Technische Hochschule Ingolstadt

Esplanade 10
85049 Ingolstadt, Germany

Phone + 49 841 9348 0
Fax + 49 841 9348 200

www.thi.de

Technische Hochschule Ingolstadt

The Technische Hochschule Ingolstadt is a dynamic University of Applied Sciences that is strongly occupied with mobility issues. We offer various study courses in this field as well as executive education. Our research institute is a strong R&D partner and the automotive research centre CARISSMA provides an excellent infrastructure.

Contact: Mr. Prof. Dr. Armin Arnold, Mail: armin.arnold@thi.de

vkm

Petersenstr. 30
64287 Darmstadt, Germany

Phone + 49 6151 16 2733
Fax + 49 6151 47 603

www.verbrennungskraftmaschinen.de

TU Darmstadt, Institut für Verbrennungskraftmaschinen u. Fahrzeugantriebe

The Institute for Internal Combustion Engines and Powertrain Systems is a subdivision of the Technical University of Darmstadt. The institute has about 70 employees, 14 of them scientific assistants. There are 12 dynamic engine test beds, 3 of them with hybrid simulation systems. Main topics are: Electrification, Methodology and Simulation, Exhaust aftertreatment, ICE Optimization, alternative fuels

Contact: Mr. Dr. Bernd Lenzen, Mail: lenzen@vkm.tu-darmstadt.de

IAD

George-Bähr-Str. 1c
01069 Dresden, Germany

Phone + 49 351 463 34827
Fax + 49 351 463 32866

tu-dresden.de/fzm

TU Dresden, IAD – Institut für Automobiltechnik

The Institute of Automotive Technology (IAD) at the Dresden University of Technology covers all automotive related topics in research and teaching. The IAD consists of the three chairs in Automotive Engineering, Vehicle Mechatronics and Internal Combustion Engines. The IAD as a main collaborative research partner of the automotive industry provides competence in modeling and simulation of various automotive domains and operates several test benches, e.g. for engines, generators, batteries and many more.

Contact: Mr. Andreas Unger, Mail: unger@iad.tu-dresden.de

UNIKASSEL VERSITÄT

Fachgebiet Fahrzeugsysteme,
Wilhelmshöher Allee 71
34109 Kassel, Germany

Phone + 49 561 804 6231
Fax + 49 561 804 6233

www.uni-kassel.de/fb16/fsg

Universität Kassel

Perform Research and Development Work in the fields of: Hardware-in-the-Loop Simulation and Modeling, Design of Experience supported Testing on Test beds for Engines and Gear Boxes, Functions development for engine ECUs.

Contact: Mr. Ludwig Brabetz, Mail: Brabetz@uni-kassel.de

Universität Stuttgart, Institut für Verbrennungsmotoren (IVK)

IVK/FKFS (Research Institute of Automotive Engineering and Vehicle Engines Stuttgart) operate various test facilities, e.g. a full-scale and a model-scale wind tunnel, a driving simulator and several engine test stands. Additionally, the institute offers support in simulation, NVH, thermodynamics, vehicle dynamics, road load studies, automotive electronic systems, communication and power networks, alternative vehicle and powertrain concepts.

Contact: Mr. Carsten Unger, Mail: info@ivk.uni-stuttgart.de

Universität Stuttgart

Paffenwaldring 12
70569 Stuttgart, Germany

Phone +49 711 685- 65624
Fax +49 711 685- 65710

www.ivk.uni-stuttgart.de

University of Bologna

The University of Bologna is considered to be the oldest University in the Western World (founded 1088). Today it hosts about 90000 students in 11 Schools, 33 Departments on 5 Campuses.

Contact: Mr. Enrico Corti, Mail: enrico.corti2@unibo.it

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

via Zamboni, 33, 40126 Bologna, Italy

Phone +33 051 209 3307
Fax +33 051 209 3313

www.unibo.it

University of Hyogo

University of Hyogo is a public university established by a local government, furnishes six schools, eleven graduate schools and four research institutes, and gives new knowledge in a wide range from liberal arts to sciences while we conduct extensive research, such as Picobiology selected as a Global COE Program.

Contact: Mr. Yukikazu Nakamoto, Mail: nakamoto@ai.u-hyogo.ac.jp

8-2-1,Gakuennishi-machi, Nishi-ku
651-2197 Kobe, Japan

Phone + 81 78 7946631
Fax +81 7945575

http://www.u-hyogo.ac.jp/english/

Zhejiang University

Zhejiang University is a comprehensive national university, founded in 1897.It's one of the earliest modern academies of higher learning established in China. Zhejiang University is a key comprehensive university whose fields of study cover philosophy, literature, history, education, science, economics, law, management, engineering, agriculture, medicine etc.

SMR Automation

Product Type	Software
Functionalities	Test Automation tool
ASAM Standards	ASAM XIL

SMR Controller

Product Type	Software
Functionalities	Calibration & Measurement Tool
ASAM Standards	ASAM MCD-1 CCP, ASAM MCD-1 XCP, ASAM MCD-2 D (ODX)

Contact: Ms. Hong Li (PHD), Mail: lihong@zju.edu.cn

CaoGuangBiao Hall 609,
College of Computer Science
38# Zheda Road
310027 Hangzhou, China

Phone +86 571 87953 172
Fax +86 571 87953 079

www.zju.edu.cn

MEASUREMENT & CALIBRATION

ASAM MCD-2 MC

ASAM MDF

DIAGNOSTICS

ASAM MCD-2 D (ODX)

ECU NETWORKS

ASAM MCD-2 NET (FIBEX)

SOFTWARE DEVELOPMENT

TEST AUTOMATION

ASAM MCD-3 MC

ASAM MCD-3 D

ASAM XIL (HIL)

DATA MANAGEMENT & ANALYSIS

ASAM CEA

ASAM ODS

For questions and further assistance, please contact the ASAM team:

Simon Preis
Business Manager

Phone: +49 8102 80 61-61
Mail: simon.preis@asam.net

For technical inquiries:

Thomas Thomsen
Global Technology Manager

Phone: +49 8102 80 61-64
Mail: thomas.thomsen@asam.net

For marketing inquiries:

Dorothée Bassermann
Marketing Manager

Phone: +49 8102 80 61-63
Mail: dorothee.bassermann@asam.net

For membership inquiries:

Katharina Löhberg
Management Assistant

Phone: +49 8102 80 61-62
Mail: katharina.loehberg@asam.net

IMPRINT

ASAM e.V. (Head Office)

Altlaufstraße 40
85635 Hoehenkirchen
Germany

Phone: +49 8102 80 61 60
Fax: +49 8102 80 61 68

info@asam.net
www.asam.net

Board of Directors:
Hans-Georg Swolana,
BMW AG (Chairman)

Raghavendra Kulkarni
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HORIBA Europe GmbH

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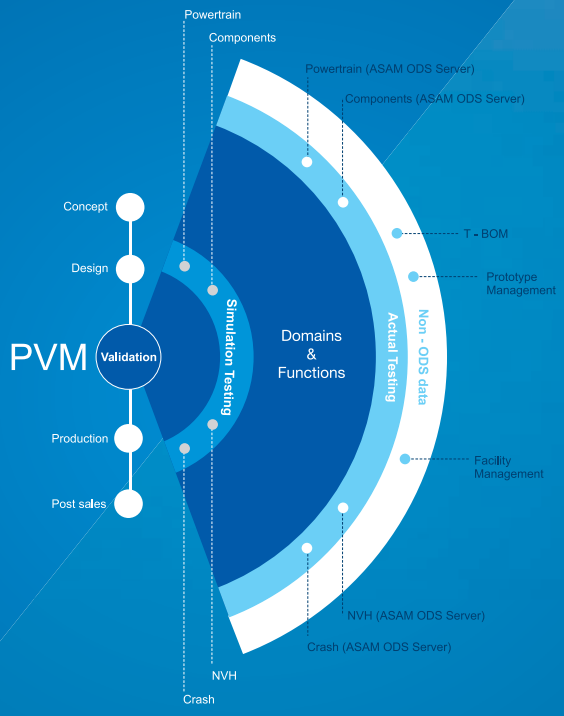
iASYS
Integrating Knowledge & Technology

YES IT CAN!

ASAM ODS standards can help in setting up complete Product Validation Management (PVM) process, across vehicle development environment.



Introducing the Web based PVMsys integration platform

- Based on ASAM ODS standard
- Independent of WEB GUI technology
- Independent of Application Model
- Inter Domain Data exchange
- Set the foundation for exchange of CAE & CAT data to support Model based Development (MBD)

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