Product information

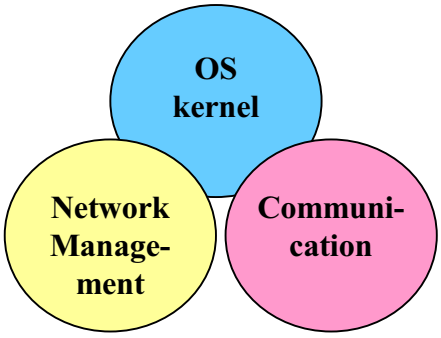
osCAN

OSEK/VDX compliant operating system

osCAN from Vector Informatik is a multitasking real-time operating system and fully compliant with the OSEK/VDX standard, version 2.0.. In addition to the OS kernel the OSEK network management and the communication protocol are available as well. This makes osCAN the first choice for CAN-bus based applications.

OSEK/VDX

OSEK/VDX is an operating system standard, which has been defined in 1997 by a joint venture of the major European car manufacturers. The acronym OSEK/VDX (**O**ffene Systeme und deren **S**chnittstellen für die **E**lektronik im **K**raftfahrzeug / **V**ehicle **D**istributed e**X**ecutive) means „Open Systems and their corresponding Interfaces for automotive Electronics". The standard is designed for embedded controllers with a minimized consumption of memory and CPU-time. Yet, as a modern operating system, it provides efficient system services, which enable the software engineer to structure the design neatly and concentrate on the application functionality. Although defined by the automotive industries, it is an interesting operating system for other applications as well.



The OSEK/VDX standard consists of three independent standards:

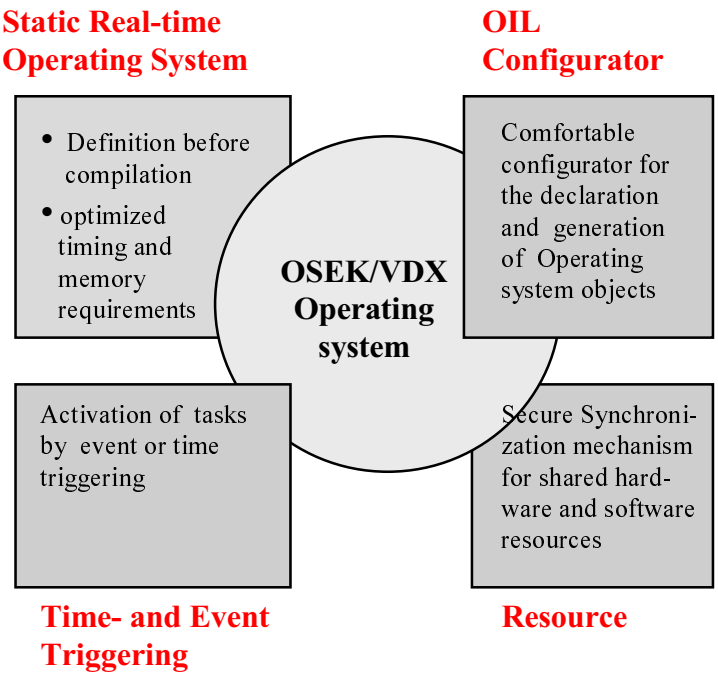
- OSEK/VDX-OS describes the application interface of the operating system kernel.
- Within OSEK/VDX-NM the algorithms are given
  - to detect the failure of a node. Immediate action can be performed to prevent dangerous situations because of invalid data.
  - to change node state from operating into sleep mode or vice versa in a coordinated way.
- The OSEK-COM communication standard defines the methods for transferring values from one task to another. Two mechanisms have to be distinguished:
  - both tasks reside on one ECU (Intertask Communication)
  - both tasks reside on different ECUs and the data has to be send over a network. This mechanism is defined as ISO-TF2/WD

Detailed information about the OSEK standards are published at
http://www-iiit.etec.uni-karlsruhe.de/~osek/.

Vector Informatik GmbH, Friolzheimer Straße 6, 70499 Stuttgart,
Tel. 0711/139996-19, Fax 0711/139996-30, Email can@vector-informatik.de,
Internet http://www.vector-informatik.de

OS System concept

OSEK is a static multitasking real-time operating system. “Static” means that all system objects are defined before compilation. This will result in optimized memory and timing requirements. System object definition is easily performed by use of the comfortable configurator from Vector Informatik.



Defined as a highly scalable operating system some features may be switched off. In order to obtain interoperability, different sets of features are defined as “conformance classes”. osCAN supports all conformance classes.

System objects are “task”, “resource”, “event” and “alarm”.

Task Management and Synchronization

There are multiple, powerful mechanisms to synchronize “**Tasks”**:

- „**Events**“ are predefined, distinguishable signals which start or wake tasks on occurrence of asynchronous external or internal trigger.
- „**Alarms**“ are a means to implement timing sequences.
- „**Resource**“ is a means to synchronize the access to shared hardware or data. In contrast with a semaphore the access to a „resource“ will raise the priority of the accessing task. Thus deadlocks and priority inversion are prevented.

Task switching is performed with task termination or occurrence of an event. For each task preemptive or non-preemptive behavior may be configured. Task scheduling is based on the priority of the waiting tasks.

Interrupts

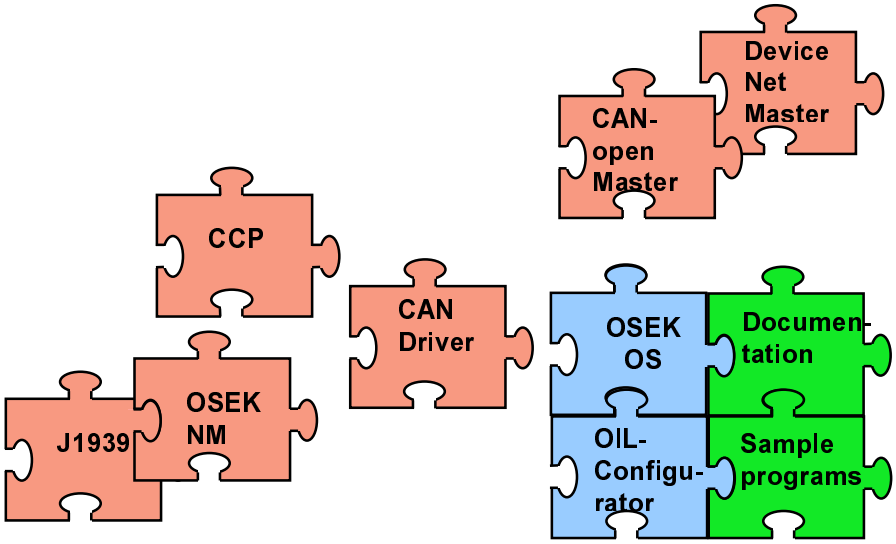
There is a set of **ISR**-modes to allow a trade-off between the duration of ISRs and the use of system calls. Various categories are defined:

category 1:	conventional ISR, no system calls
category 2:	most system calls available, additional CPU-time needed
category 3:	start with conventional ISR and optional switch to category 2 when needed.

Vector Informatik GmbH, Friolzheimer Straße 6, 70499 Stuttgart,
Tel. 0711/139996-19, Fax 0711/139996-30, Email can@vector-informatik.de,
Internet http://www.vector-informatik.de

CAN Modules

The basic osCAN-OS bundle may be enhanced by a choice of CAN-bus software modules for almost every application.



For industrial purposes the widely used **CANopen** and **DeviceNet** protocol stacks may be chosen. Automotive applications are provided with the complete set of software modules like CAN-driver, network management, transport protocol, Can Calibration Protocol etc.

The **automotive CAN Driver** implements routines for initialisation, transmitting and receiving of CAN messages, and error handling. The data structures for the communication objects are generated once at compile time and linked to the code, both residing in ROM The application uses handles and does not need to know the contents of the communication objects. In the current version the CAN Driver supports

- the CAN Calibration Protocol (CCP)
- the Transport Protocol according to ISO/WD 15765-2
- the requirements of the OSEK Network Management or other car manufacturer specific Network Managements
- Interaction Layer functionality.

For automotive applications the car manufacturers distribute a CAN database which contains all required information to configure the communication procedures. A comfortable editor to handle this database is delivered with the CAN Driver. This **CANdb editor** may also be used to configure a proprietary network. For each ECU the generated data is:

- Message dispatch table for messages to be received
- Receive messages structures (RAM/ROM separation, call-back functions)
- Transmit messages structures (RAM/ROM separation, confirmation function)
- Node number for network management
- Message structures for segmented data transfer

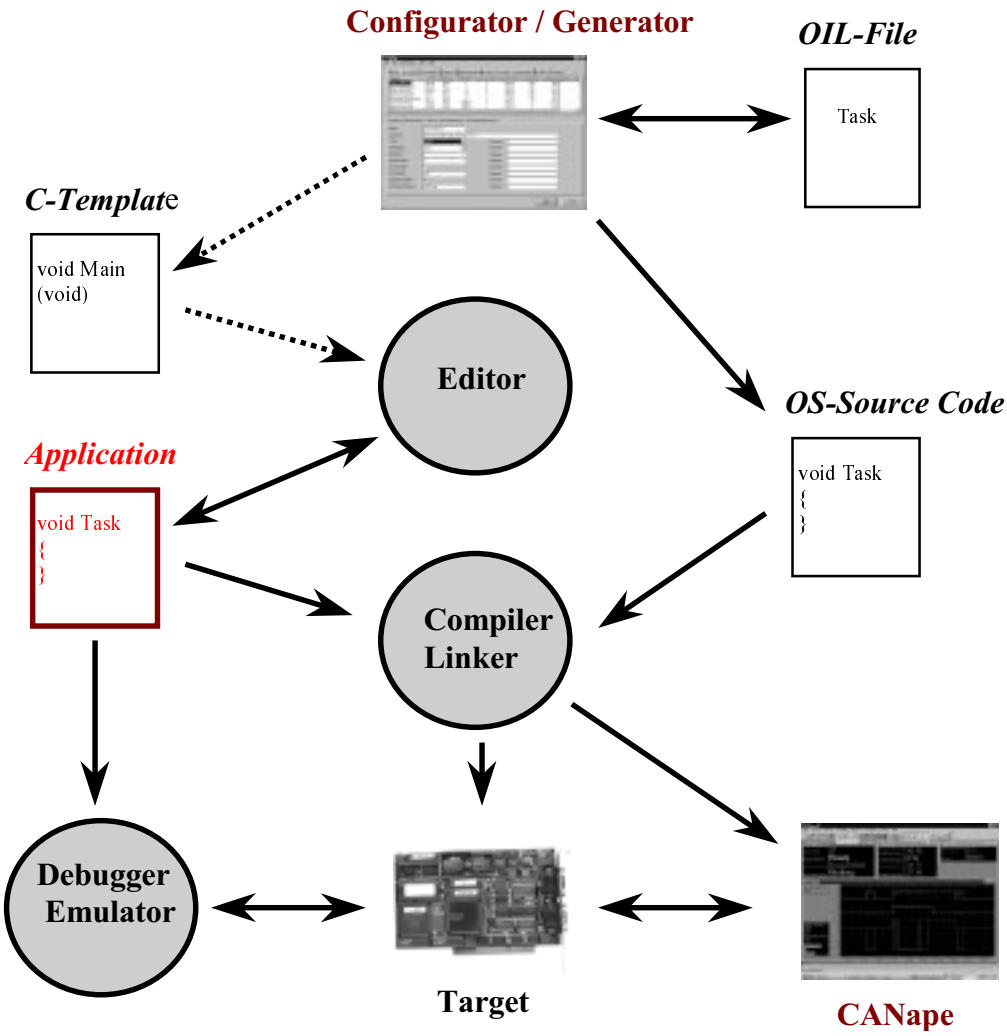
An OSEK-COM **Transport Protocol** is also available. The software module realises the algorithm of the Transport Protocol which has been specified in the ISO-WD 15765-2. The addressing mode (normal/extended) and the data model (data is copied by the Transport Protocol or by the application) can be configured statically at compile-time.

Vector Informatik GmbH, Friolzheimer Straße 6, 70499 Stuttgart,
Tel. 0711/139996-19, Fax 0711/139996-30, Email can@vector-informatik.de,
Internet http://www.vector-informatik.de

Development Environment

Using OSEK does not differ much from the standard development routine. The main difference is the definition of system objects. Vector Informatik delivers a comfortable graphical tool with osCAN to this purpose. This tool may be used to generate a C template file, when starting a new project. The template file contains the task's bodies and a first set of system calls to known objects.

Of course the system may be configured and reconfigured any time while you implement your application. The **configurator** will not perform any modification on the application source code. Only the linker will merge the system configuration and the application source code.



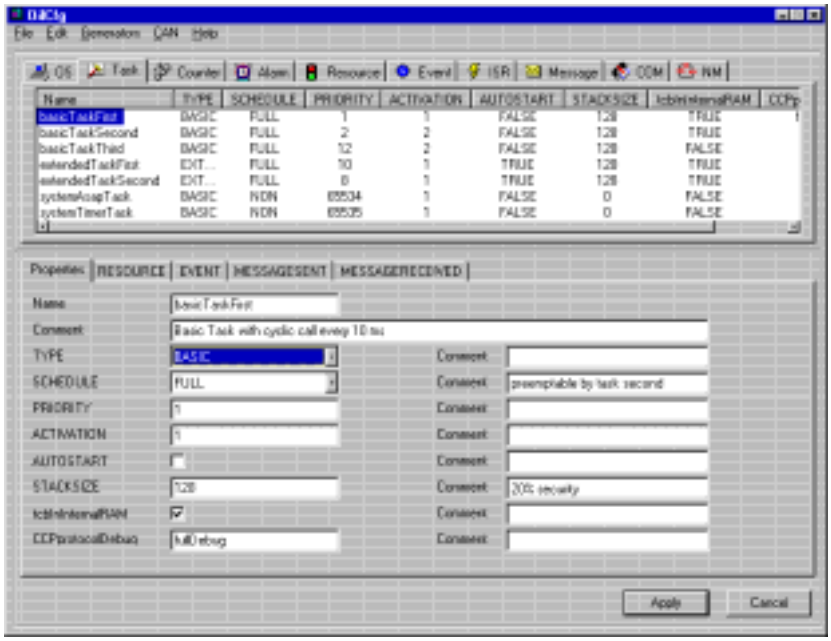
Debugging is performed as usually. Vector Informatik offers with **CANape** a powerful tool to monitor the target system via the CAN-bus online but remote. This allows a debugging in standard operating conditions when an emulator is no more applicable.

With **CANoe-OSEK** there is also a **simulation** tool available from Vector Informatik. Designed for the support of system design and integration of CAN-networks CANoe offers the possibility to design the application according to the OSEK standard and simulate it on a PC.

OIL Configurator

For OSEK/VDX a script language (**O**SEK **I**mplementation **L**anguage) exists for the definition of system objects. Vector Informatik delivers a comfortable graphical interface, called OIL-configurator, for the definition and parameterization. With this tool project management becomes easier.

As shown below a clearly arranged set of tags allows the direct access to each object. When selecting a specific item the respective parameters and the related objects are shown.



In addition to the standard OIL parameters the Vector configurator contains some switches for controller specific optimization.

The menus allow the selection of different projects or the assignment to an other derivative of the chosen processor family. The generating tool can be invoked directly from the menu bar as well.

When the generating tool is activated or a configuration is stored, the configurator performs a set of plausibility checks. Thus it is ensured that the system is consistent. The major benefit of this feature is the certainty that the chosen settings will remain within a given conformance class.

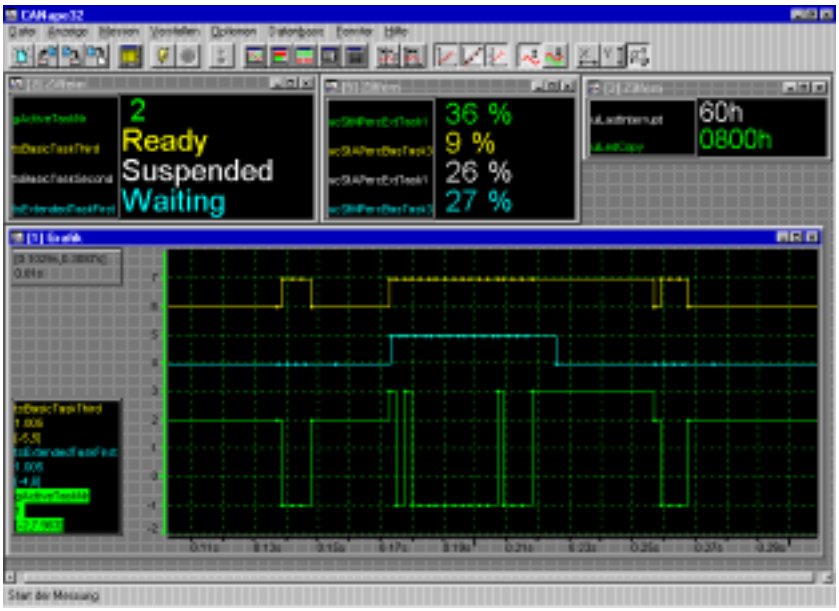
As interrupts are an important procedure in embedded controller applications, Vector has intergrated a “ISR” tag into the configurator. This tag supports an easy and clearly arranged set up of the interrupt vector table.

The configurator offers the possibility to generate a template C-file “main.c”. When starting a new project this template might be a help or introduction into OSEK. Within this template file the blocks for the defined tasks are generated. For all other objects like events or alarms sample calls for initialization and handling are inserted, showing the correct syntax. Of course the configurator checks the existence of any “main.c” file. Thus there is no risk of damage for an actual project.

Debugging

Debugging of an application can be done using standard tools. Vector Informatik offers with CANape a tool, which enables the engineer to “debug” also in cases where a standard emulator is not applicable. With this tool operating system objects may be monitored remotely via the CAN-bus.

It is important to know, that data is accessed with the “CAN Calibration Protocol” (CCP), which is a common protocol within automotive applications. I.e. there are no modifications to the operating system necessary.



Among the information available the most important displays are:
- task switching and task states
- stack consumption per task
- error codes

All display windows are generated automatically. You only have to select the desired information by a specific switch within the configuration tool.

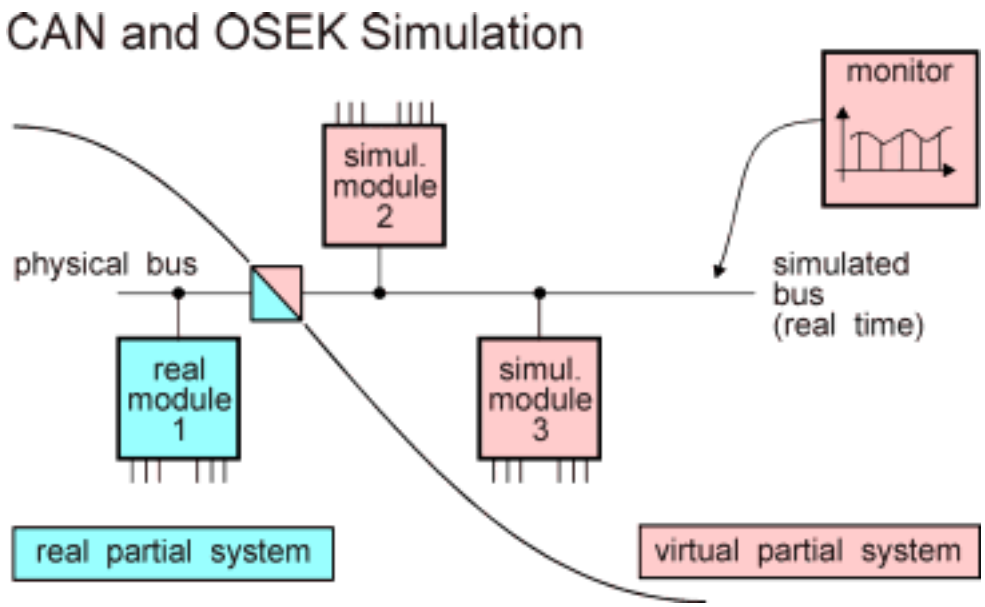
Of course this feature is embedded into the standard operation of CANape. Thus it is possible to watch operating system behavior simultaneously with analog or digital inputs.

As the CCP protocol is required, this approach is not applicable with CANopen or DeviceNet protocols.

Simulation

CANoe is a powerful tool for the simulation of applications within a CAN network environment. Together with the CANoe-OSEK-OS library the mechanisms for the bus simulation can be used for simulation and test of OSEK-OS applications as well. Thus software development can progress before availability of target hardware.

The library permits to run various OSEK applications for multiple networked controllers simultaneously on a PC. The user implemented application is compiled by a standard C-compiler and linked to the CANoe-OSEK-OS library.



I/O interfaces of the hardware may be simulated completely by CANoe. I.e. outputs are displayed and inputs are processed. This is achieved by the generic interface offered by the environment variables of CANoe. The user has to implement only an abstraction layer. This layer will be replaced by the specific I/O access when porting to the target hardware. The maximum count of environment variables, i.e. I/O channels, is almost unlimited.

The application code being standard C-code can be tested with standard **debugging aids**. The simulation allows a stop of the global timer whenever the debugger steps through application code.

Access to the **CAN-bus** is performed using the Vector CAN-Driver API. In this way higher level modules like network management or communication protocols may be included into simulation and test as well. Thus it is possible to run the application only with minor modifications as a CANoe simulation as well as on the target hardware.

Vector Informatik GmbH, Friolzheimer Straße 6, 70499 Stuttgart,
Tel. 0711/139996-19, Fax 0711/139996-30, Email can@vector-informatik.de,
Internet http://www.vector-informatik.de

Availability

osCAN is available for Fujitsu's

- 16-bit processor series **F²MC16LX** or
- the 32-bit families **MB91100** and
- **MB91360**.

Yet, osCAN and OSEK in general are on purchase for other platforms as well.
As a host system Windows™ 3.11 / 9x / NT might be used.

Vector Informatik – Your Partner

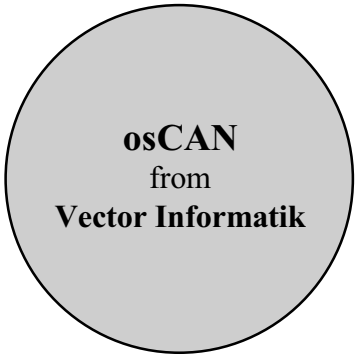
Vector Informatik is the leading provider of tools and solutions for CAN-network based embedded applications. As a highly renown partner of the car manufacturing industry Vector Informatik has many years of experience developing operating systems and is an active member of the OSEK/VDX standardization team.

Dedicated to support the customers in an optimum way Vector offers a complete set of services. While the development of standard tools and protocols for CAN-bus applications is the main focus of Vector Informatik, the expertise of Vector's engineers is available for customer specific software implementations as well. Training courses and hotline by phone or e-mail as well as on-site support guarantee a n unproblematic use of Vector's software modules.

A **wide variety of products**

- all processor sizes (8 to 32 bit)
- Network management
- Communication moduls
- CAN-drivers

controlled **Software Quality Management**



World wide support
Europe - Stuttgart
USA - Michigan
Japan - Tokyo

ISO 9001 certified

Established in car-manufacturing and automation industries

Complete Support

- Development tools
- Training
- Application design
- Hotline

Vector Informatik GmbH, Friolzheimer Straße 6, 70499 Stuttgart,
Tel. 0711/139996-19, Fax 0711/139996-30, Email can@vector-informatik.de,
Internet http://www.vector-informatik.de

Vector Informatik

Europe
Vector Informatik GmbH
Friolzheimer Straße 6
D-70499 Stuttgart
-Germany-

Phone: +49 711 139996-34
Fax: +49 711 139996-80
e-mail: brock@vector-informatik.de
http://www.vector-informatik.de

USA
Vector CANtech, Inc.
Mr. Bruce Emaus
Suite 190
39500 Orchard Hill Place
Novi, Mi 48375
-USA-

Phone: +1 248 449-9290
Fax: +1 248 449-9704
e-mail bruce@vector-cantech.com
http://www.vector-cantech.com

Japan
Vector Japan Co., Ltd.
Mr. Kentaro Yamauchi
Kyobashi Yayoi Bld. 5F
2-11-6 Kyobashi, Chuo-ku
104-0031 Tokyo
-Japan-

Phone.: +8/-(03)-5524-0902
Fax: +8/-(03)-5524-0905
e-mail can@vector-japan.co.jp
http://www.vector-japan.co.jp

Distributors

Netherlands

Micro-key bv
Industrieweg 28
NL-9804 TG Noordhorn

Tel: +31 594 50 3020
Fax: +31 594 50 5825
http://www.microkey.nl

France

NSI S.A.
Parc des Glaisins
6, Avenue du Pré de Challes
F-74943 Annecy-le-Vieux Cedex

Tel.: +33 4 50 09 4630
Fax: +33 4 50 09 4631
http://www.nsi.fr

Italy

MICROTASK Embedded S.r.L.
P.zza Virgilio, 3
I-20123 Milano

Tel.: +39 02 4982051
Fax: +39 02 4986949

Great Britain

Accutest Limited
Suite 2
9 George Street
Glossop
GB-Derbyshire SK13 8AY

Tel.: +44 1457 866613
Fax: +44 1457 856789
http://www.accutest.co.uk

Sweden

Kvaser AB
P.O. Box 4076
SE-51104 Kinnahult

Tel.: +46 320 15287
Fax: +46 320 15284
http://www.kvaser.se