



- Flexible Hardware & Software Architecture
- Scalable Sensor, Actuator & Micro Controller Modules
- Open for Client Control Software
- Ready for Production Code Generation
- Robust Electronic Layout
- OSEK V⁺ Operating System & Powerful Driver Libraries
- Standard Automotive Interface Support
- MATLAB/Simulink[®] Support

VEMAC VeRa

Rapid Control Prototyping System

PRODUCT MOTIVATION

For developing future drive trains (CI or SI engines, manual or automated transmission, hybrids or fuel cells) with alternative energy sources (liquid or gaseous fuels), higher comfort systems and safety issues (ABS, ESP, ...) the portion of electronics, software and mechatronics in vehicles will grow further. Due to the reduction of development periods and the increasing system complexity, modern engineers need high performance development tools. In case of electronic control systems development Rapid Control Prototyping Systems (RCPS) are the state of the art development tools. For excellent assistance and results the RCPS must be scaleable to various projects, but should not differ so much to the series layout, to achieve an easy transfer from the prototype to the series solution. **VeRa** combines the flexibility of sensor and actuator demands in prototyping, with the requirements in reliability and cost effort of series systems.

HARDWARE DESIGN

VeRa consists of four modules (base module, micro controller module, sensor module and actuator module) which are exchangeable each (see figure 1). The base module is the heart of **VeRa**. It combines the sensor and the actuator module with the intelligence of the micro controller module. To provide the maximum regarding flexibility the base module is equipped with an automotive

FPGA, powerful digital interfaces (CAN, RS232, BDM) and all stabilized power supplies. The intelligence of **VeRa** is represented by the micro-controller module with a state of the art automotive processor (MPC 565) including the necessary infrastructure like memory RAM and Flash ROM. The current layout of the sensor and actuator boards is defined for engine control purposes (*details see table 1*). The complete electronic is boxed in a robust metal housing for a hard industrial use. Also the main connector is performed as an automotive solution with water protection.

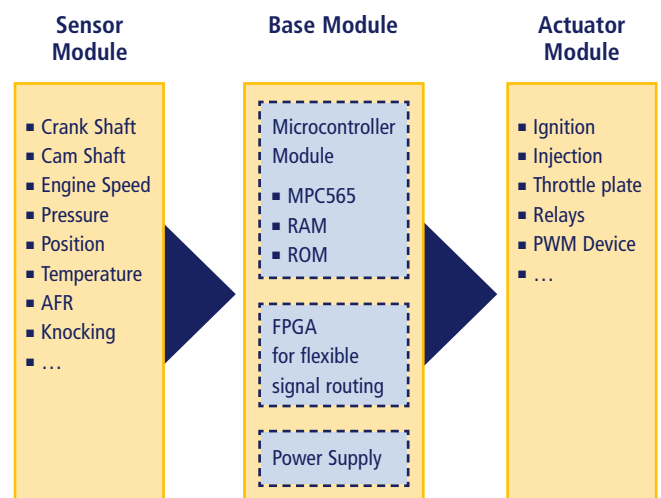


Figure 1: VeRa Hardware Structure

Base Module

Power Supply	8..30V
Temperature	0..70°C, -40..120°C (optional)
Internal Voltage	5V@5A, 3,3V@5A
Sensor Voltage	5V@3A
FPGA	Automotive
Communication	2xCAN 2.0B (1MBit/s), 2xRS232 (max. 115kBit/s), K-Line (optional), LIN (optional), BDM

Processor Module

Controller	Freescale MPC565, Floating-Point-Unit, 3 TPUs with 16 channels each
Clock	56MHz
RAM	max. 8MB (external), 36kB (internal)
ROM	max. 16MB (external), 1MB (internal)

Sensor Module

Analog Inputs	max. 20x, Resolution 10 Bit
Digital In/Outs	max. 10x, DI, DO, PWM
Communication	1x SPI
Current Configuration:	
Crank Position	1x VRS or 1x Hall, VRS: max. ±100V, Hall: TTL, 60-2 a. 36-1 teeth wheels
Cam Position	1x Hall, TTL, various teeth configurations
Barometric Pressure	1x internal 15..115kPa, 2x external (MAP Sensor)
Temperature	3x NTC (i.e. MAP Sensor, Cooling water, ...) 2x TC (exhaust temperature)
Position Sensor	3x Potentiometer (i.e. throttle pos., pedal pos.,...)
Lambda	1x Wideband AFR probe
Knock Sensor	2x Piezoelectric vibration sensors
Supply Voltage sens.	1x 0..30V
Gen. Purpose AI	5x 0..5V
Gen. Purpose DI	5x Input voltage conf. (i.e. for ignition, engine start, ...)

Actuator Module

Analog Inputs	max. 15x, Resolution 10 Bit
Digital In/Outs	max. 35x, DI, DO, PWM, etc.
Comm.	1x SPI, 1x Serial, 2x CAN
Current Configuration:	
Injection	6x Solenoid Injectors, 12V, 2A
Ignition	6x Ignition coils, 12V, 10A, SCIS 300mJ
Throttle Actuator	1x DC Motor Throttle Actuator, 12V, 5A
Communication	1x RS232 max. 115kBit/s, 2x CAN 2.0B (1 Mbit/s)
Gen. Purpose DO	24x Relay, resistive or inductive loads, 12V, 0,5/1A, DO or PWM
Connector	18x Power Contacts, 116x Signal Contacts

Table 1: Technical details of VeRa

SOFTWARE DESIGN

VEMAC provides a model based software approach. Therefore **VeRa** is complemented by an embedded software design composed of the OSEK V⁺ (OSEK/VDX conform real-time OS), a communication module and hardware driver libraries based on the Automotive-HIS Standard (see figure 2). The operation system permits the use of modular software structures for the control program. This strategy enables the reusability of audited program sources in future projects. **VeRa** uses for

communication to an application tool the CCP (XCP) protocol. For time-critical functions (see table 2) an optimised TPU driver library is available.

TPU drivers
Crank position & Engine speed
Cam position
Cylinder individual ignition
Cylinder individual injection
Knocking window
Synchronous & asynchronous PWM

Table 2: Available TPU drivers

VeRa supports the open software philosophy, where clients can program their own control software and transfer it to the RCP hardware. Therefore a model based tool-chain for software development is supported. C-Code generated by the widespread Matlab/Simulink® is compiled by a GNU GCC based compiler. Due to the consequent attention to the automotive standards and series requirements the developed software has a high potential regarding series application. By considering basic programming principles it is possible to generate production software code.

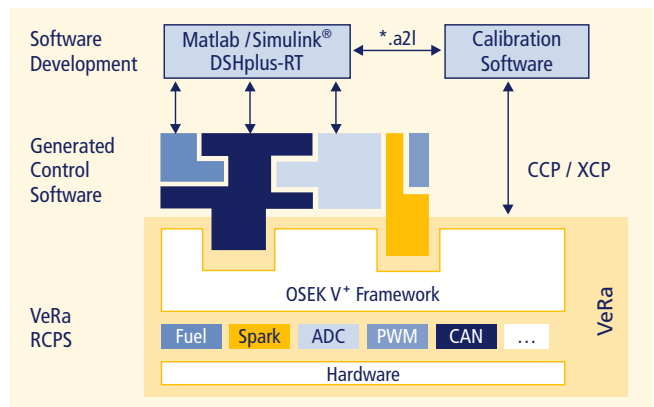


Figure 2: VeRa Software Structure

MISCELLANEOUS

VEMAC also provides special software tool chain adaptations to use DSHplus-RT to develop control software. DSHplus-RT is a graphically orientated simulation software which can be used to describe mechatronic systems including electronic control systems. For more detailed information to DSHplus-RT see www.fluidon.de.

SERVICE

VEMAC provides client individual adaptations at the software tool chain and the hardware modules. Also client individual control software development is offered. For more detailed information please contact our experts.