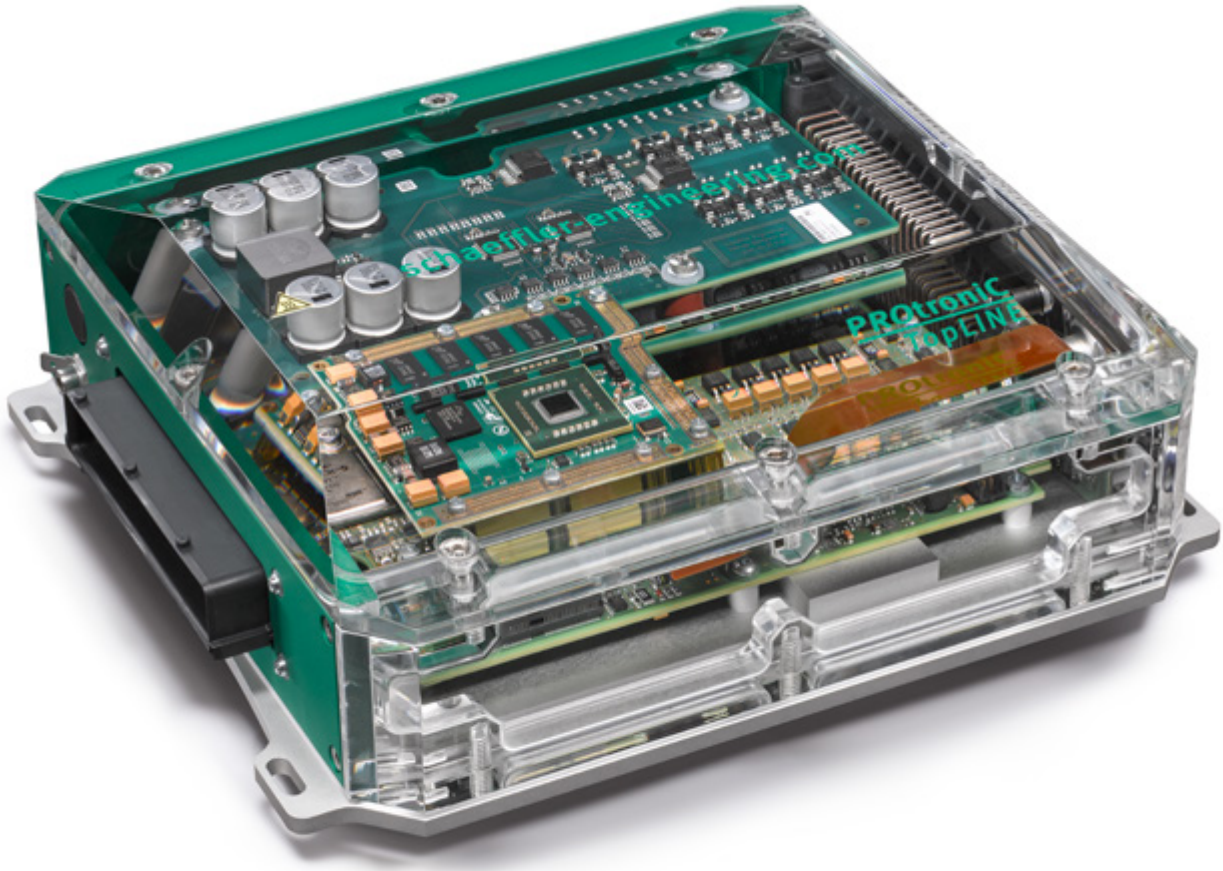
SCHAEFFLER
ENGINEERING



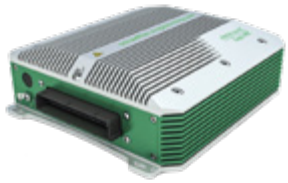
PROtroniC TopLINE

High-Performance Rapid Control Prototyping

FOR ALL
THOSE
WHO ARE
DEVELO-
PING TO-
MORROW
TODAY.

Seamless from design to series – PROtroniC TopLINE makes it possible

Getting new approaches to solutions up and running quicker and easier in a prototyping control unit, and testing under realistic conditions – that is rapid control prototyping. But the ***PRO*troniC** *TopLINE* goes even one step further. Our control unit bridges the gap between two worlds, R&D and series.



The ***PRO*troniC** *TopLINE* is the 3rd generation of prototyping control units since 1989.

The core of the ***PRO*troniC** *TopLINE* is a real-time processor unit with dual PowerPC architecture, extensive communication interfaces and state-of-the-art FPGA (Field-Programmable-Gate-Array) technology.

A Freescale PowerPC processor with 1 GHz processing power and double-precision floating-point unit is exclusively reserved for processing the application software. A second processor relieves the main processor from all peripheral and communication tasks.

The processing-intensive and time-critical preparation and pre-processing of the bus, sensor and actuator signals have been transferred to especially configured FPGAs. As a result, the system is not only flexibly adaptable and expandable for future tasks, but also sets standards in terms of processing power.

Newly developed functions can be verified directly using the integrated data logger. Once configured, the data logger works independently and the recorded measurement and calibration variables can be transferred to a PC via the Ethernet connection. In this way, the test results are immediately documented and can subsequently be communicated back to the simulation to carry out further optimizations.

Three good reasons for the PROtroniC TopLINE:

1. The„All On Board“ Concept

Extensive signal conditioning and power stage outputs are already included in the ***PRO*troniC** *TopLINE*.

2. Innovative FPGA technology

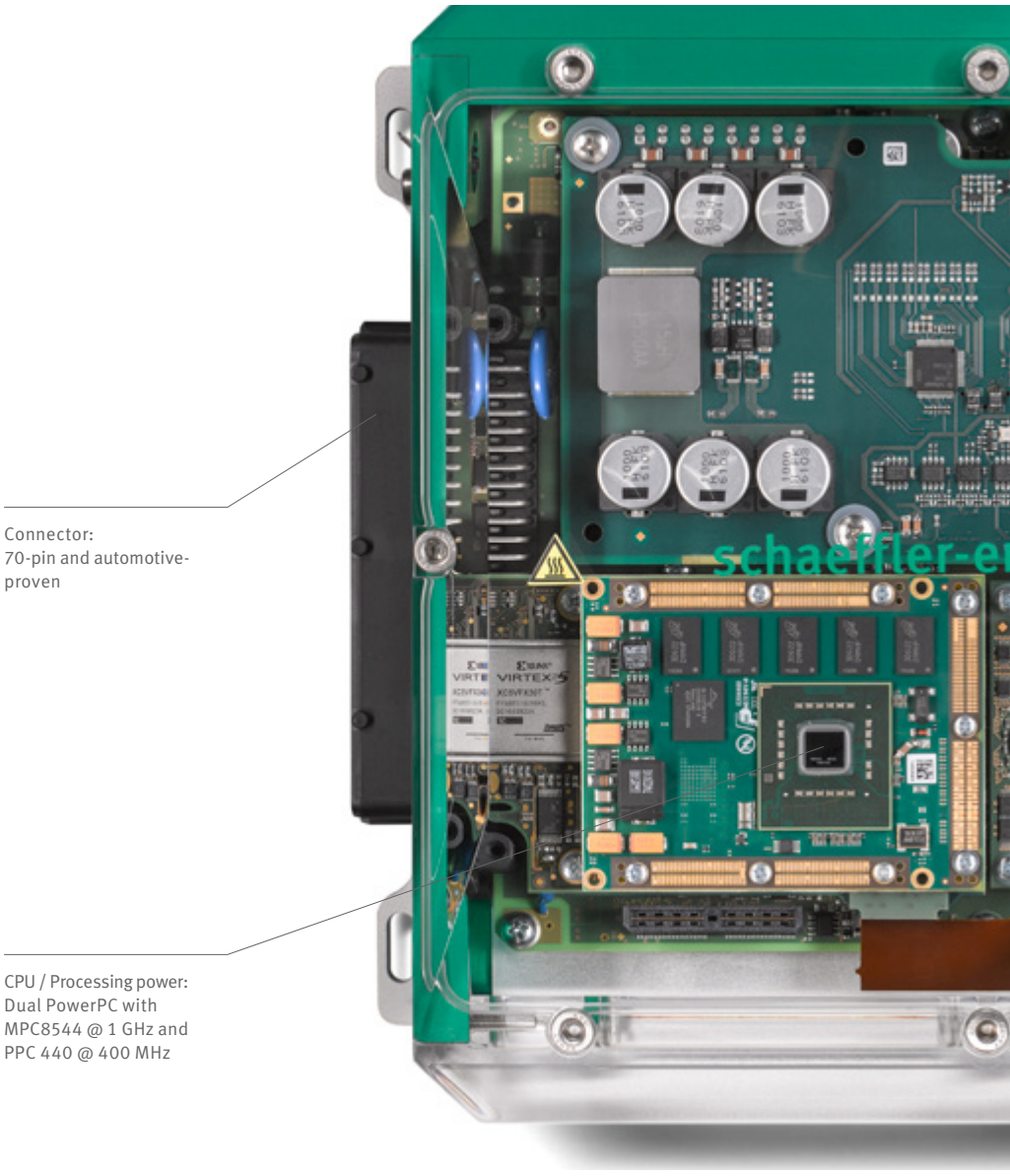
All inputs and outputs can be quickly and easily configured to the particular application.

3. Tough and Robust:

The ***PRO*troniC** *TopLINE*-supports current vehicle electrical systems and is designed for use in rough environments, e.g. underhood.

The *TopLINE* variant is designed for use in rough environments.

Convincing inner values and almost infinite application options

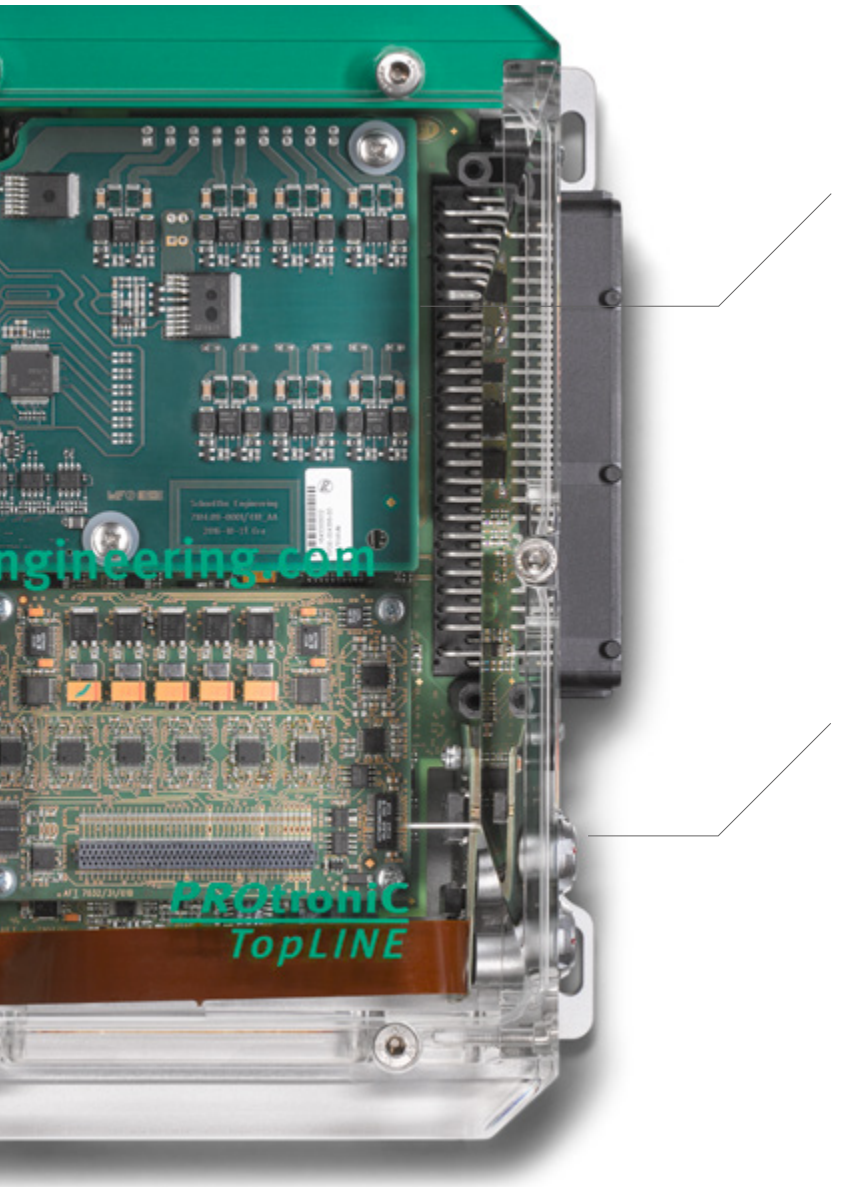


A „Safety on Board“ concept is available for the PROtroniC TopLINE that consists of two components:

- A multilevel monitoring concept for developing application-specific safety functions in the prototyping system
- The use of development tools approved for developing according to ISO 26262

The benefits of the „Safety on Board“ concept:

- Working in a model-based development environment – for the development of safety related functions as well
- Fast realization of application-specific safety functions – already during the prototyping stage
- Reducing software efforts – by using existing system monitoring and fault detection functionality
- High system safety for fleet and on-road testing – with configurable reactions to detected faults
- Using the same prototyping tool-chain – for prototyping and production



Vehicle bus interfaces:
1 x FlexRay, 4 x CAN and 2 x LIN

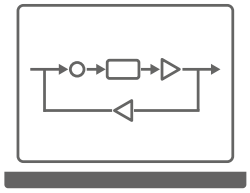
Communication interfaces:
2 x Ethernet and 2 x LVDS

One platform and a lot of application options

- **Engine management**:
  Engine control management (gasoline, diesel), new combustion methods (HCCI), component development (Turbocharger, exhaust gas systems)
- **Transmission management**:
  Automatic and automated transmissions (AT, DCT, CVT), component development (Shift charger, hydraulic module)
- **Alternative drive systems**:
  Hybrid and electric concepts (HV, EV), alternative fuels (H_2, CNG, LPG, biofuels)
- **Chassis and vehicle dynamics:**
  Active steering and suspension, chassis mechatronics ABS, ASR, ESP
- **Body and comfort electronic**:
  Roll-over protection for convertibles, air-conditioning and heating systems, door, window, sliding roof and mirror modules
- **Driver assistance and safety systems**:
  Distance, brake, light and lane assistance, parking assistance, collision warning system

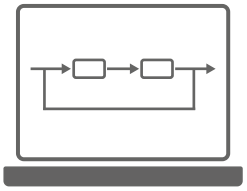
Six steps from idea to reality

The development environment of the ***PRO*troniC** *TopLINE* is based on tools that are widespread in the automotive industry. It offers free scope when choosing the code generator and the measurement and calibration tools.



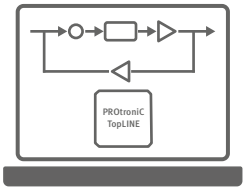
1) Model-based software development

- Graphical modelling of control functions with MATLAB®, Simulink® and Stateflow®



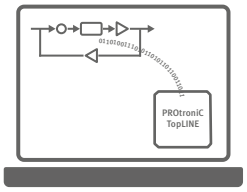
2) Offline simulation

- Testing and optimisation of the functional design against a plant design using offline PC simulation with MATLAB®, Simulink® and Stateflow®



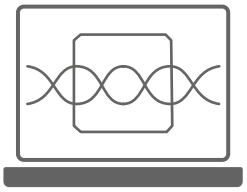
3) Hardware mapping

- Mapping and configuration of the control functions in the model to the inputs and outputs of the hardware using a graphic block library based on Simulink®: Application Controller Interface (ACI)



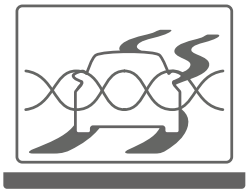
4) Automatic code generation

- Generation of highly efficient production code at the press of a button, alternatively with the code generators TargetLink® or Embedded Coder™



5) Testing and verification

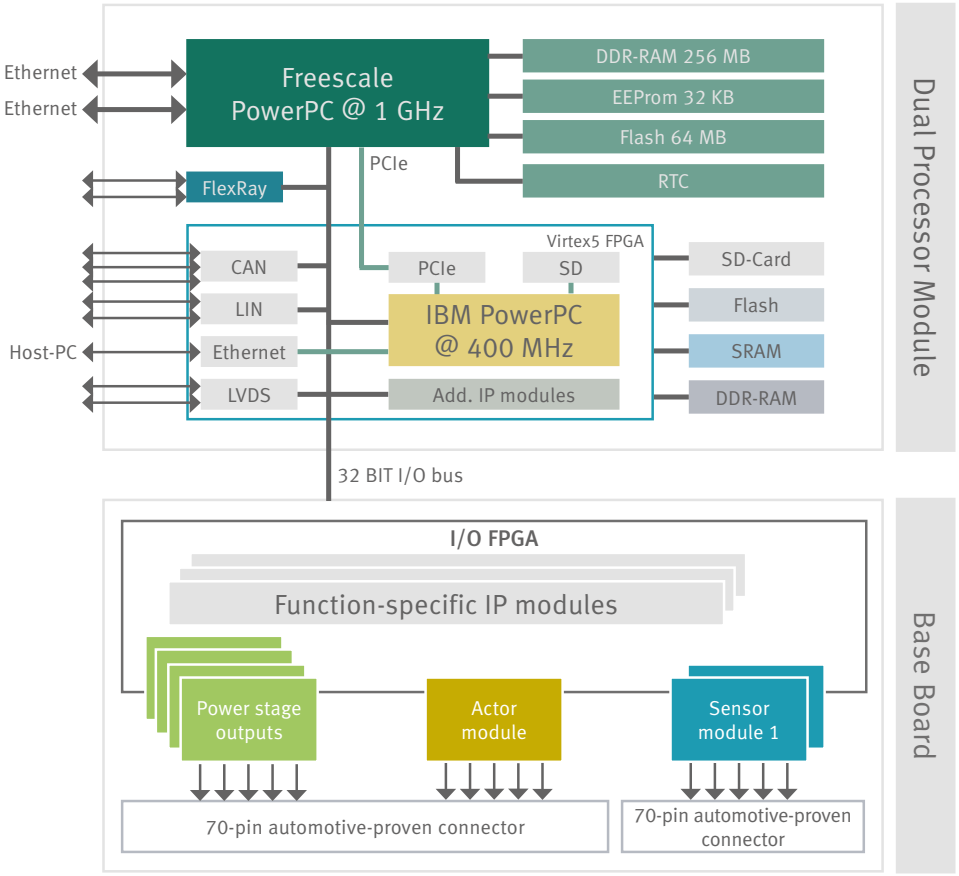
- Downloading the generated software to the control unit with the boot loader tool
- Testing and verification of the newly developed control functions on a test-bench, in the vehicle or via hardware-in-the-loop simulation



6) Measurement and application

- Fine-tuning and measurement of the control functions using a measurement and calibration tool, alternatively via MARC I, INCA or CANape

Hardware architecture and details



Hardware architecture of the PROtroniC TopLINE

Overview PROtroniC TopLINE

Design	Modular design, different sensor and power stage modules available
Attributes	Robust, compact & fully automotive-proven
CPU / Processing power	Dual PowerPC: MPC8544 @ 1 GHz & PPC 440 @ 400 MHz
Vehicle bus interfaces	1 x FlexRay, 4 x CAN, 2 x LIN
Communication interfaces	2 x Ethernet, 2 x LVDS
Calibration interfaces	XCP on Ethernet
I/O stages	Comprehensive analog and digital I/Os
Signal conditioning	Integrated signal conditioning, HW- and SW-configurable
Power stage outputs	Extensive number of flexible, configurable power stage outputs
Housing in mm (W x H x L)	281 x 86 x 250

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