PROtronic LINE
The All-rounder for Rapid Control Prototyping

SCHAEFFLER ENGINEERING
Our Mission: to revolutionize your Rapid Control Prototyping

Bringing your developments on the fast-track
Getting new approaches to solutions up and running quicker and easier in a prototyping control unit. Testing under realistic conditions while keeping the production objectives in mind. That is production-oriented rapid control prototyping—but what if it were even faster and easier?

Our developers are familiar with the two worlds of prototyping and production development, and know what really matters. Therefore, our PROtroniC LINE bridges the gap between both worlds and fast-track your developments at the same time.

What to expect
- The established “All On Board” concept: extensive signal conditioning and power stage outputs are already included in the TopLINE und BaseLINE versions.
- Innovative FPGA technology: all inputs and outputs can quickly and easily be configured to the particular application using a Windows™ tool.
- Tough and robust: all PROtroniC versions support the current vehicle electrical systems and are designed for use in rough environments, e.g. underhood.

Functional safety on board—from the very first development step
We have developed a “Safety on Board” concept for our PROtroniC LINE, that consists of two parts:
1. A multilevel monitoring concept for developing application-specific safety functions in the prototyping system.
2. The use of development tools certified for developing accord. to ISO 26262.

The benefits of our PROtroniC LINE with 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
**TopLINE and BaseLINE**

The perfect duo for development

**PROtronic TopLINE—The "High-Performance" Version**

The core of the PROtronic 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.

**PROtronic BaseLINE—The "Close-to-Production" Version**

As with production control units, a powerful microcontroller of the type Freescale MPC5554 is used in the PROtronic BaseLINE. Similar to the TopLINE, state-of-the-art FPGA technology is used to assist the microcontroller in computing-intensive peripheral tasks and to ensure the required flexibility for the inputs and outputs.

Due to the compact housing and the low starting price, the PROtronic BaseLINE is the right prototyping platform for cost-sensitive applications and fleet tests.
Convincing inner values—
The design of the PROtronic BaseLINE

**PROtronic LINE**—The right tool for every application

**Engine management**
- Engine control management—Gasoline, diesel
- Development of new combustion methods (HCCI)
- Component development—Turbocharger, exhaust gas systems

**Transmission management**
- Automatic and automated transmissions—AT DCT, CVT
- Component development—Shift charger, hydraulic modules

**Alternative drive systems**
- Hybrid and electric concepts (HV, EV)
- Alternative fuels—H2, CNG, LPG, biofuels
Convincing inner values—
The design of the PROtronic TopLINE

Chassis and vehicle dynamics
- Active steering and suspension
- Chassis mechatronics
- ABS, ASR, ESP

Body and comfort electronics
- 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
The differences between *BaseLINE* and *TopLINE* at a glance

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<th>Configuration</th>
<th><strong>PROtroniC versions</strong></th>
<th><strong>PROtroniC BaseLINE</strong></th>
<th><strong>PROtroniC TopLINE</strong></th>
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<tbody>
<tr>
<td>Design</td>
<td>Modular design, different sensor and power stage modules available</td>
<td>Modular design, different sensor and power stage modules available</td>
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<tr>
<td>Attributes</td>
<td>Robust, compact and automotive-proven</td>
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<td>Dual PowerPC MPC8544 @ 1 GHz, PPC 440 @ 400 MHz</td>
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<tr>
<td>CPU / Processing power</td>
<td>Single PowerPC MPC5554 @ 120 MHz</td>
<td></td>
<td>1 x FlexRay 4 x CAN 2 x LIN</td>
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<tr>
<td>Vehicle bus interface</td>
<td>3 x CAN 2 x LIN</td>
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<td>1 x FlexRay 4 x CAN 2 x LIN</td>
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<td>Communication interfaces</td>
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<td>2 x Ethernet 2 x LVDS</td>
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<td>Calibration interfaces</td>
<td>CCP on CAN</td>
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<td>Input / Output stages</td>
<td>Comprehensive analog and digital in- and outputs</td>
<td>Comprehensive analog and digital in- and outputs</td>
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<td>Signal conditioning</td>
<td>Integrated signal conditioning, HW- and SW-configurable</td>
<td>Integrated signal conditioning, HW- and SW-configurable</td>
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<tr>
<td>Power stage outputs</td>
<td>Extensive number of flexible, configurable power stage outputs</td>
<td>Extensive number of flexible, configurable power stage outputs</td>
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<tr>
<td>Integrated data logger</td>
<td>—</td>
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<tr>
<td>Housing in mm (W x H x L)</td>
<td>280 x 63 x 196</td>
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<td>281 x 86 x 250</td>
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Making ideas reality—Smooth transition from design to production

The development environment of the PROtronic LINE is based on tools that are widespread in the automotive industry. It not only offers free scope when choosing the code generator but also for 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 calibration
   - Fine tuning and measurement of the control functions using a measurement and calibration tool, alternatively via MARC I, INCA or CANape.