Technical Data

SCHAEFFLER ENGINEERING

***PRO*troniC** *BaseLINE*

Article-No.: 1012002

Variant UCU-FS (Universal Control Unit for Functional Safety)

As with series control units, a powerful microcontroller of the type NXP MPC5554 is used as a real-time computer unit in the ***PRO*troniC** *BaseLINE*. As with the *TopLINE*, state-of-the-art FPGA technology is used to assist the micro-controller in computing-intensive peripheral tasks and ensure the required flexibility for the inputs and outputs. Due to the compact housing and the low starting price the ***PRO*troniC** *BaseLINE* is the ideal solution for fleet tests and cost-sensitive applications.

Basic System	
Operating Voltage:	6.5 V … 32 V DC
Temperature Range:	-40 °C … +85 °C housing temperature
Electrical Strength:	Short-circuit against Ground and V_{Bat} for all power supply terminals Power switches are also protected against overload
Mechanical Stress:	Vibration and temperature testing according to DIN ISO 16750-3 Part 4.1.3.1.5.2, DIN EN 60068-2-64
IP code (EN 60529):	IP64K
EMV Stability:	Interference emission/reception tests, CE conformal
External Connector:	2 x 70-pin (AMP)
Housing:	Aluminium, (W x H x L) 280 mm x 63 mm x 196 mm
Weight:	3.4 kg

CPU	
Processor:	MPC5554 (120 MHz, Floating-Point-Unit)
Memory:	Flash: 2 MByte (µController internal) 8 MByte (µController external) RAM: 4 MByte external (64 KByte µController internal) EEPROM: 32 KByte (µController external)
Debug Interface:	JTAG and NEXUS via adaptor box[1]
I/O-Processor:	Automotive FPGA (for time and crank-angle synchronous control of the actuators / sensor analysis)

Communication Interfaces	
CAN:	2 x CAN 2.0 B Full-CAN Transceiver (High-Speed, 1 MBaud max. / ISO DIS 11898)
LIN (available as an option)[1] [2]:	2 x LIN, according to LIN specification 1.3, 2.0, 2.1, 2.2 Configurable as LIN-Master or LIN-Slave
SENT[5]:	6 x SENT, according to SENT specification SAE J2716 Configurable in groups of 3 as SENT-Master or SENT-Slave

For further information and a current price list, please contact us at: info@schaeffler-engineering.com

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Analog Inputs	
Number:	24, 4 groups each with 6 channels Standard hardware set-up: 6 x: U = 0 ... 10.14 V, fc = 14 kHz, typical application: load amplifier, pressure sensor 2 x: U = 0 ... 10.14 V, fc = 1.4 kHz, typical application: pressure sensor, active sensors 6 x: U = 0 ... 5.07 V, fc = 0.7 kHz, typical application: pressure sensor, active sensors 6 x: U = 0 ... 5.07 V, fc = 0.7 kHz, typical application: temperature sensor 4 x: U = 0 ... 5.07 V, fc = 0.7 kHz, typical application: potentiometer, positional sensor
Resolution:	12 Bit
Input Voltage:	Uni-polar or bi-polar (depending on hardware set-up)
Input Filter (analog):	Low-pass 1st order, cut-off frequency can be set via hardware set-up
Input Filter (digital):	Low-pass 1st order, cut-off frequency configurable
Dynamic Behaviour:	Sampling rate per channel: › 100 kHz
Signal Types:	▪ Analog input ▪ Digital input (with programmable threshold and hysteresis)
Sensor Supply:	Per group: 0 V ... VBat / 100 mA

Anlog Outputs, alternative[3] to Analog Input Group 4	
Number:	6, one group with 6 channels
Resolution:	12 Bit
Output Voltage:	0 ... 10 V/max. 10 mA
Dynamic Behaviour:	Update rate: 70 kHz

Crankshaft Inputs	
Number:	2 x hall sensor input: measurement range 0 ... 5.06 V, fc = 66 kHz 2 x inductive sensor input: measurement range -29.9 ... + 29.9 V, fc = 16 kHz Common sensor voltage Further inputs for processing of crank circuit signals available for fast digital inputs / outputs.
Operating Range:	Engine speed 50 ... 12000 rpm[4]
Crankshaft Tooth System:	Configurable, 36 – 3600 teeth with 1 to 4 gaps or one additional tooth, e.g. 36±1, 60-(1...4), 60-1-1 (symmetrically), 360 increments / revs, 3600 increments / revs, etc.
Camshaft Tooth System:	Configurable, 1 to 15 teeth
Resolution:	0.1 °KW
Sensor Type:	Inductive or hall
Dynamic Behavior:	Sampling rate per channel: 500 kHz
Sensor Supply:	0 V ... V_{Bat}/100 mA

Fast Digital Inputs / Outputs	
Number:	12, 2 groups each with 6 channels, in groups as input / output configurable
Input:	5 … 32 V, threshold configurable group-wise Standard equipment: 24.8 kΩ, pull-down
Output:	Push/pull output 75 Ω
Input signal types:	▪ Digital input ▪ Pulse and frequency measurement input ▪ Event generation at edge change input
Output signal types:	▪ Digital output ▪ PWM output

Power Switch Outputs	
Number:	24, 4 groups with 6 channels each
Supply:	Per group, 6.5 … 52 V external
Output:	Push/pull, low side or high side output 5 A, 11 A peak Parallel switching of up to 6 channels possible Load capacity of supply: max. 20 A per group
Signal Types:	▪ Digital output ▪ PWM output, 20 Hz … 10 kHz ▪ Full bridge output, 20 Hz … 10 kHz ▪ Peak & Hold output, 20 Hz …10 kHz ▪ Peak & Hold current measurement ▪ Pulse output (angle-synchronous) ▪ Ignition output (control of external power stages), max. 20 ms ▪ Current controlled output

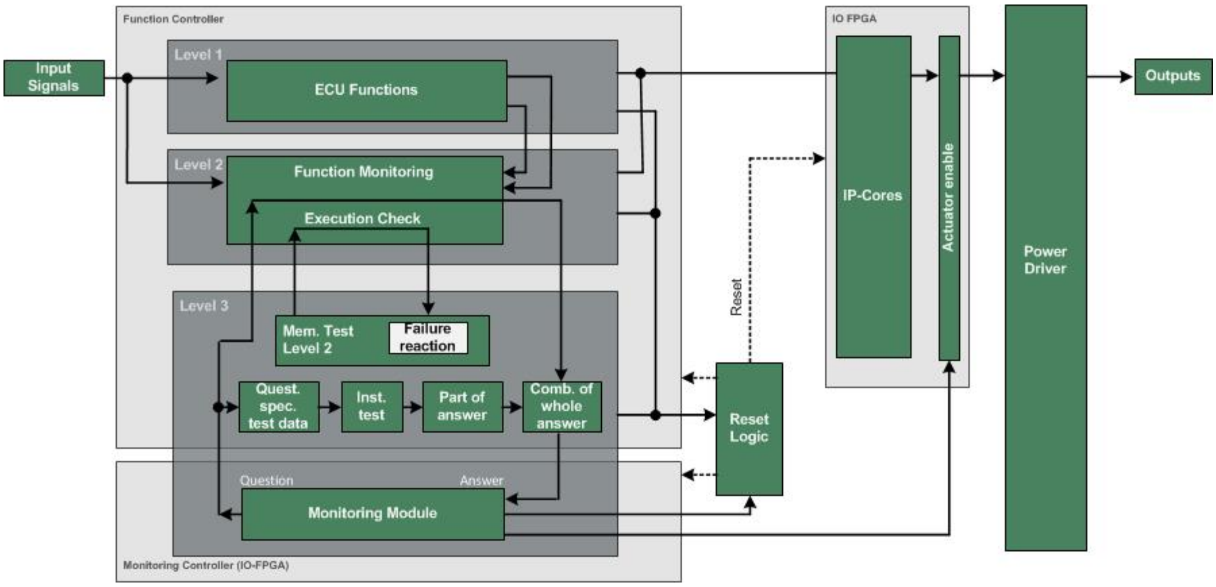
Ignition Outputs	
Number:	6, one group with 6 channels for control of an external ignition power stage Diagnosis functions of external ignition power stage
Output:	0 … 4.6 V, push/pull voltage output or 8 … 25 mA power output, max. 16 V
Signal Types:	Ignition Control

1) Additional hardware module required.
2) Additional software required (LIN ACI-Blockset).
3) Not included in standard version.
4) For incremental sensors, a lower maximum rev. speed applies depending on the number of teeth.
5) While using the SENT interface the fast digital I/O groups will be reduced by one.

Functional Safety Concept of ***PRO*****troniC** *TopLINE* UCU-FS

The functional safety concept of the ***PRO*****troniC** *TopLINE* UCU-FS consists of two main parts:

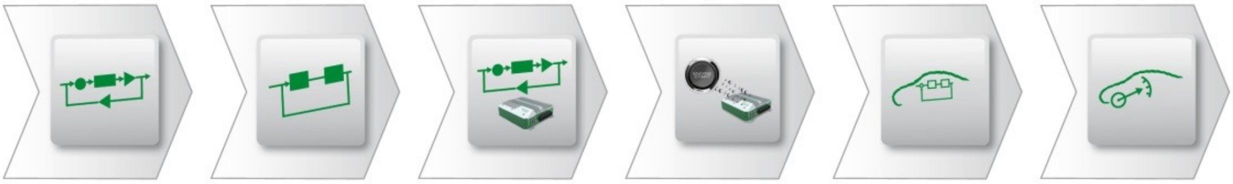
1. A multilevel monitoring concept for developing application-specific safety functions in the ***PRO*****troniC** control unit.



Overview Safety Concept:

- Main CPU runtime monitoring with independent safety processor
- Freely programmable monitoring level (level 2) to verify correct execution of main software
- Enforcement of defined state of inputs and outputs on detected faults
- Configurable shut-down trigger option from desired software level, to ensure a safe state of system on detected faults
- Monitoring of functional code execution
- Monitoring of runtime response and instruction code test
- Monitoring and diagnostics of system integrity and supply voltages
- Extensive diagnostics functions of the inputs and outputs
- Initial and cyclic check of system memory (RAM, code and data segments)
- System-watchdog
- Integrated fault detection and fault memory functionality
- Max. number of re-start trials configurable by user
- Option to switch off the safety functions for development and test purpose

Development Environment



Smooth transition from design to mass production

The development environment of the ***PRO*****troniC** *TopLINE* 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 modeling of control functions with MATLAB®, Simulink® and Stateflow®.

2 Offline simulation

- Testing and optimisation of the functional design against a plant design using offline simulation on the PC 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 Test and verification

- Downloading the generated software to the control unit with Schaeffler Engineering boot loader tool.
- Testing and verification of the new developed control functions on a test-stand, 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 with MARC I, INCA or CANape.