

EFFICIENT TESTING OF ELECTRONIC CONTROL UNITS IN AUTOMOTIVE

Today's cars are highly integrated and interconnected. Up to 150 embedded Electronic Control Units (ECU) in a car secure a comfortable, convenience and safety driving experience. Examples of this ECUs include transmission modules, air conditioning systems, and even self-updating 5G-ready telematics control units.



R&S®CompactTSVP

Your task

To meet the demands of capabilities such as automated driving, in-car infotainment systems, remote diagnostics, and electrical powertrain the vehicle architecture is evolving, moving from distributed single-core ECUs to high-performance compact multi-core digital platforms. CAN, LIN, FlexRay™ and Automotive Ethernet enable fast data communication between ECUs and sensors.

Since most of the ECU functions are safety relevant, the highest level of reliability is required, at all times and in all conditions. The electrical integrity of each function needs to be verified covering the product lifecycle from development to production.

The sensor signals need to be simulated by certain voltages, currents and frequencies. The actuators require a certain load (resistor) to simulate e.g. the electronic drive motor of a window.

Different signal generators, analyzers and load units need to be connected to each other and to the device under test (DUT) in an efficient, compact test setup. It should be possible to configure the test system (modules, interfaces, DUT adapter) and develop the test cases of the automatic software programs based on the DUT's test specification.

It should be easy to adapt the test system solution to the hardware and software components and different types of ECUs. The system should be able to flexibly adapt to different measurement tasks and operate reliably. Built-in self-testing capability and in-system calibration are needed to ensure the reliability of the system.

Rohde & Schwarz solution

The PXI based R&S®CompactTSVP platform is a test system for functional and in-circuit testing in mass production. The R&S®CompactTSVP offers the previously mentioned requirements in one single test system. The internal signal bus concept in combination with internal multiple switch matrix cards (4 × 90 each) provides reliable, flexible and efficient signal routing between test and measurement instruments, switching relays and DUTs.

Expensive, less reliable external cabling is not required, so it is much easier to keep track of the signal routing. The R&S®CompactTSVP has a rear I/O concept for connecting

Application Card
Version 01.00

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Make ideas real



additional power supplies and loads. These power lines are routed via high-power switching cards to the fixture interface on the front of the instrument, which keeps the measurement setup simple.

The signal routing library makes it easy to program complex signal connections between measurement modules and the DUT. Users can tailor the test system to their test plan and flexibly configure up to 14 measurement and switching modules.

A single-slot, dual-channel floating arbitrary waveform generator simulates sensor signals or generates clock or pulse signals for testing analog digital converters (ADC) and frequency to voltage converters (FU). The isolated outputs allow direct generation of differential signals. On the actuator side, the single-slot, eight-channel floating signal analyzer monitors dynamic current consumption (pulses) via a shunt resistor. Floating inputs are mandatory to directly connect the shunt to achieve high current resolution.

The multimeter module (R&S®TS-PSAM) covers all voltage, current and resistor measurements for functional testing (FCT) and in-circuit testing (ICT). The internal bus system connects any current sensor on the switching cards with the R&S®TS-PSAM for current measurements.

Internal and external loads are connected to the individual control signals to test the ECU's actuator signals. High current switching cards from 2 A up to 50 A with integrated current measurement capability route external loads from the rear of the R&S®CompactTSVP to the front, which makes the setup neat and efficient.

To ensure high reliability, the test system has an integrated self-test and in-system calibration routines. The self-test measures the contact resistance of all switching cards without any additional cabling or specific adaptation.

The in-system calibration allows all measurement modules in the R&S®CompactTSVP chassis to be calibrated with an external multimeter.

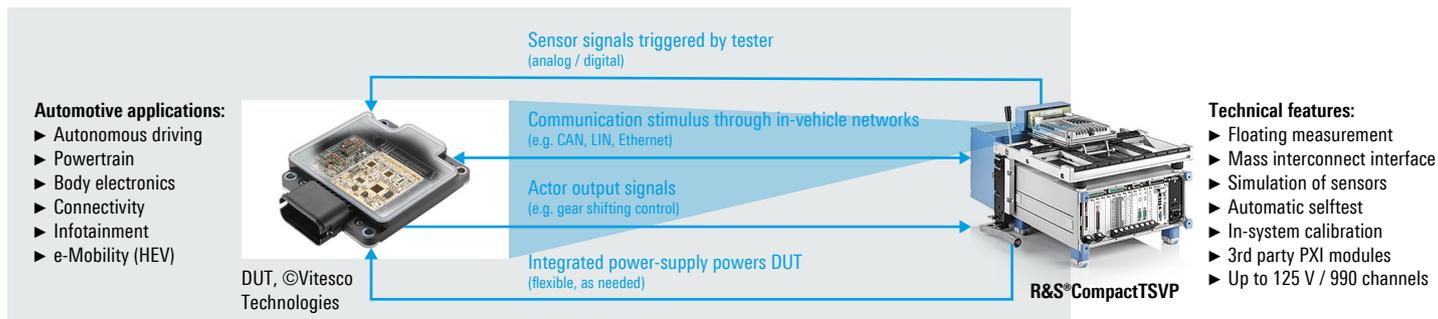
The core of any test system is software that runs all required tests in production automatically. Thanks to the open software concept, all common programming languages such as C, C#, LabWindows/CVI and the test management software TestStand can be used for easy integration into existing test system software.

All software components such as the user interface for the installed R&S®TSVP modules, instrument drivers, self-test, in-system calibration and ICT with debugger and automatic test generator are included in the R&S®GTSL generic test software library and do not require a software license.

The measurement modules for functional testing can be reused for ICT – a true investment saving. A specific version of the mass interconnect interface from Virginia Panel can be connected directly to the R&S®CompactTSVP chassis and modules without any interface cabling. This ensures a highly reliable signal connection without degrading the signal quality.

ECU test with R&S®CompactTSVP

R&S®Compact TSVP – modular and compact test solution for ICT, FCT and JTAG/boundary scan tests for automotive ECUs



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