

# Test Systems for Simulating Any Conceivable Test Scenario

## From contacting and signal conditioning to mechatronic, environment, error and driver simulation

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Modern vehicles are full of increasingly complex vehicle components and ECUs. They contain extensive hardware and software functionality that has to be checked, verified and safeguarded from all sides. This task is particularly challenging because it takes a long time during vehicle engineering before these components are installed in a real vehicle and can thus be tested in a real environment. With individual function and hardware-in-the-loop (HiL) test systems, any conceivable test scenario can be covered and easily simulated in the laboratory without risking real vehicles or endangering the lives of test drivers.



Driver simulation for force sensitive switches

The test systems are individually tailored to the relevant target system which is reproduced with simulated and partly also with real vehicle environments. For this purpose, tried and tested hardware and software components specified by the customer are usually combined with individual simulation and test components. Softing Automotive offers an extensive test kit for this purpose, based on decades of experience.

### Particular Focus on Contacting, Error Simulation and Signal Conditioning

High flexibility is the prerequisite for the most universal possible use of a test system. The particular focus on contacting ensures a highly reliable connection of the device under test (DUT). For this purpose, connection

cables with original connectors for use in the laboratory or in the climate chamber, complex needle bed contacts for series tests and also hand contacts, for example, are used. Another important focus is error simulation with which the diagnostic capability of the ECU is ensured. This means that errors such as "Short circuit to UBatt", "Short circuit to ground" and "Open load" can be verified for individual pins without damaging the error simulation or the connected measurement technology. Softing has a number of different error simulations available which have proved themselves for many years now in a large number of test systems of all kinds of ECUs. They can easily and flexibly be integrated into the test system via the CAN interface. Finally, attention also has to be paid to signal conditioning when connecting the ECU sensors and actuators to measurement

and data acquisition systems (DAQ). Depending on the signal type, easily scalable and highly reliable modules are used for this purpose, for example for adapting current and voltage levels, galvanic isolation, protective circuitry or signal filtering.

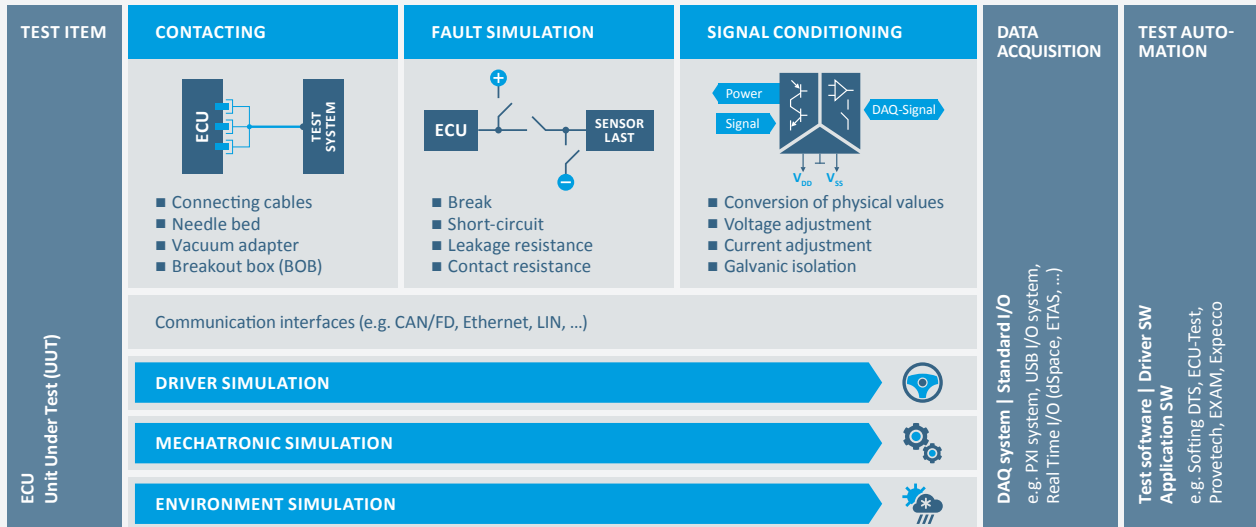
### The Advantage: Comprehensive Use Case Scenarios

The Softing test systems are distinguished by the fact that a wide variety of applications can be defined. One example of this is the driver simulation: Today, the interaction between the driver and the vehicle is extremely complex. Modern vehicle cockpits have a large number of controls. Even simple cockpit elements, such as indicator levers, have a considerable range



Environment simulation: rain light simulation

## TEST SYSTEM SETUP



Softing test systems offer comprehensive functionality for a wide range of applications

of functions: movement up, down, forward and backward, movement in different steps and/or time-dependent, rotation in different steps as well as a pushbutton at the end of the lever. Infotainment controls with all kinds of mechanical switches, touch elements, swipe and wipe functions, proximity sensors, pressure-sensitive switches etc. are even more complex. In an automated, reproducible test system, it must be possible to simulate these operating processes in a suitable manner and to control them from the test system. Modern ECUs in which the electronics form a closed unit with actuators and sensors are another challenge for test systems. For example, an electric steering system only has electrical connections for power supply and communication interfaces, while all other connections and links, such as the connection of

the steering wheel, take place mechanically via a jacket sleeve or the connection of the steering motor axle to the steering gear and wheels. For simulation, suitable pressure must now be applied and recorded by the test system on both sides: on the driver's side, the steering movement and the haptic feedback from the chassis, and on the steering side, the resistance that the chassis and road offer the steering. This mechatronic simulation makes it possible for the test system to address the actuators (e.g. with rotary or stroke movements) or enables the conversion of sensor signals, such as speed, force, pressure, heat or light into electrically measurable quantities. A high-performance test system should also be able to provide a suitable simulation of the environment. Here, it is no longer just a case of simulating electrical signals, but

also of generating physical quantities to stimulate sensors. Light intensity simulates the environment, such as a tunnel, light refractions simulate rain, forces describe torsional forces on the steering wheel, the weight on the seat occupancy mat or the vehicle load. Pneumatic pressure is used to simulate door crash sensors and tire pressure, wheel speed is simulated by rotational movements, acceleration simulates parking bumps, and ultrasound simulates interior monitoring. In this way, different events can be simulated and the corresponding ECU response or control behavior tested and documented.

### Diverse Areas of Application and Advantages

Due to their all-encompassing design, test systems from Softing Automotive are suitable for a wide range of applications. This includes, for example, tests of control units and functional tests in engineering, manufacturing and endurance tests as well as the testing and release of vehicle components and ECUs. The modular structure, scalability and extensibility are an advantage. The comprehensive know-how and the long-term experience guarantee the very best quality. Furthermore, the test kit makes a fast and flexible realization of the test system possible.

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Mechatronic simulation: force measurement and influence on the window regulator