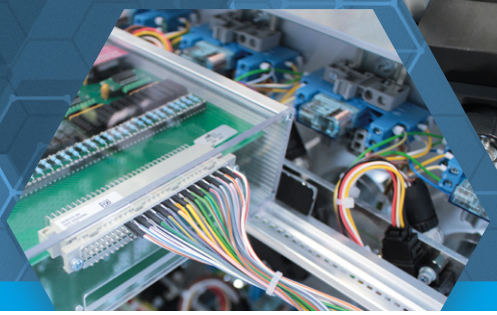
optimize! softing

TEST SYSTEMS

MASTERING TEST COMPLEXITY – BENEFITING FROM THE TEST KIT



FUNCTION AND HIL TESTER IN A MODULAR SYSTEM – FOR (ALMOST) ALL ECU TYPES, DATA ACQUISITION SYSTEMS AND TEST AUTOMATION PLATFORMS

It is a long journey from the start of engineering to the installation of all vehicle components and ECUs in the production vehicle. Comprehensive testing of the electronic components during the entire engineering process is essential. This is the only way to thoroughly safeguard and optimize hardware and software functions. Errors can be detected and remedied quickly – the earlier the better.

But for a long time during engineering, there is no real ECU environment available for the necessary testing – much less a complete vehicle. To solve this test problem, function and hardware-in-the-loop (HiL) test systems are used. These are set up with simulated and partially real vehicle environments. This allows (almost) all expected scenarios to be simulated, the ECU response to be tested, and the effect on the subsystem or vehicle to be recorded and documented.

The requirements made of these test systems are as diverse as they are complex. In the search for the right solution, it quickly becomes apparent that standard products are often just as poorly suited to the specific requirements as the interfaces of the specific ECU to the I/O channels of measurement technology.

This is why here at Softing we always design and implement our test systems individually to suit your specific ECU. In doing so, we combine the established hardware and software components you specify with our own solutions – building on our sound know-how and using our extensive test kit.

In order to be able to cover as many conceivable test scenarios as possible, we rely on individually tailored solutions for contacting, fault simulation, signal conditioning, as well as driver, environment, and mechatronic simulation. Together with the appropriate test automation software, the required test scenarios can thus be mapped with automated tests and documented results. All tests are easy to perform in the lab – on virtual test tracks in the desert or at the Arctic Circle; they can be reproduced at any time, without real vehicles and without risking the life and limb of test drivers.

Take advantage of our long years of comprehensive experience in the design and realization of test systems. We love nothing more than to take on what seem to be irresolvable challenges – and sometimes even make the impossible possible.

PORTFOLIO

- Function tester
- Component and integration HiLs

COMPONENT TEST KIT

- Contacting
- Fault simulation
- Signal conditioning
- Complex simulations (driver, environment and mechatronic simulation)
- Other test equipment (connection cables and distributors, breakout boxes, test adapters)

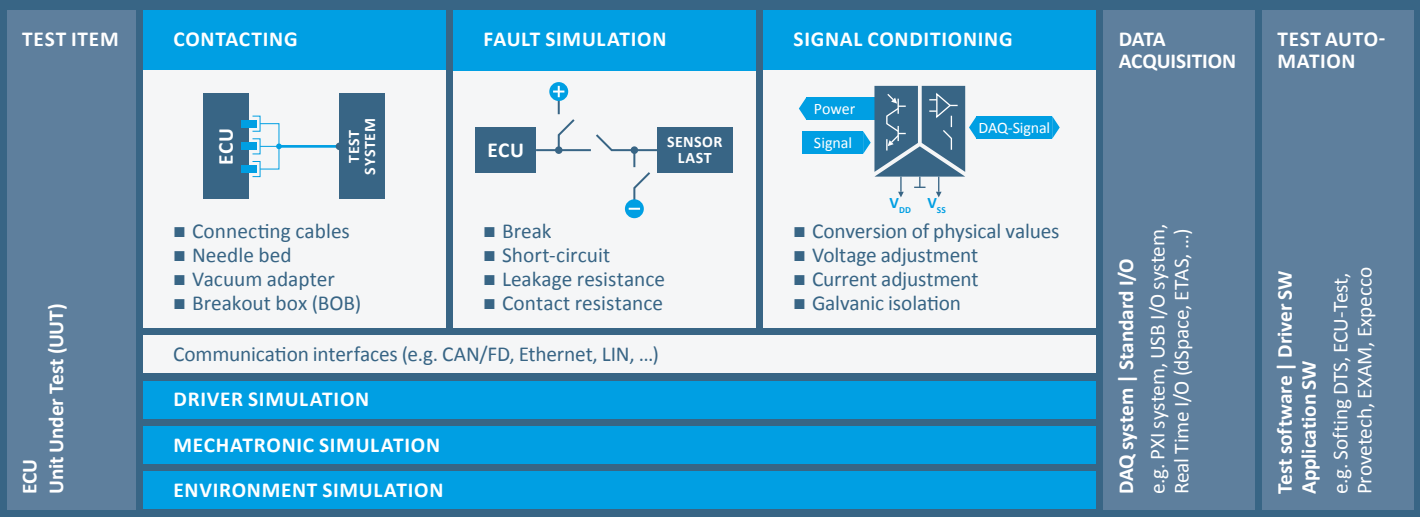
AREAS OF APPLICATION

- ECU and function tests in engineering
- Manufacturing and endurance test
- Testing and approval

BENEFITS

- Modular, scalable and extendible complete solutions
- Top quality thanks to comprehensive know-how and many years of experience
- Fast, flexible realization and support on site by qualified employees

TEST SYSTEM SETUP



CONTACTING

Connection cable with original connectors for laboratory or climate chamber, individual special solutions in the 3D printing process, complex needle bed contacting for series tests or hand contacting – we will manufacture these and many more items to completely satisfy your requirements. For the highly reliable connection of your Unit Under Test (UUT) with the test system, in best quality and durable design!

PORTFOLIO

- ECU connection cables
- Needle bed contacting
- PCB adaptations
- HV ECU adaptations

Fig.: Sample contacting ▶

FAULT SIMULATIONS

Safeguarding the on-board diagnostic capability is a key part of the ECU test. “Short circuit to UBatt”, “Short circuit to ground” and “Open load” all have to be tested individually for every ECU pin. Naturally neither the fault simulation nor the connected measurement technology may be damaged in the process. Our fault simulations are easy and flexible to integrate in all kinds of testers via CAN. The range of tests can also be extended by connecting cascadable leakage resistors. Our fault simulations have been working reliably for many years in a large number of test systems of all kinds of ECUs!

PORTFOLIO

- Fault simulation (integrated in test system)
- Autonomous fault simulation (for ECU OBD tests in the lab, on the test board or in the vehicle)

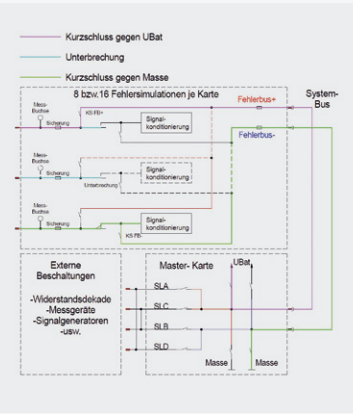


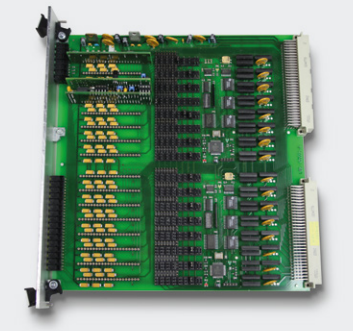
Fig.: Schematic for fault simulation ▶

SIGNAL CONDITIONING

The signals from the ECU sensors and actuators cannot be connected directly to measurement and data acquisition (DAQ) systems – the signal always has to be adapted. Depending on the signal type, our signal conditioning offers all the necessary functionalities: Adjustment of current and voltage levels, galvanic isolation, protective circuitry and signal filtering. Our test kit contains the appropriate signal conditioning modules for all common ECU signals – easy to scale and highly reliable.

PORTFOLIO

- Sensor simulations, for all common ECU inputs and sensor types such as temperature, speed, pressure, resistance, etc.
- Real load connections and load simulations, with integrated current/voltage measurement and signal conditioning for lamps, valves, engines, etc.



▲ *Fig.: Signal conditioning modules*

DRIVER SIMULATIONS

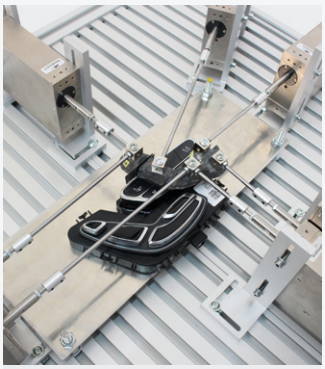
The interaction between the driver and the vehicle is extremely complex. Modern vehicle cockpits have a considerable number of controls that can and must be used by the driver. Even simple cockpit elements, such as indicator levers, have a considerable range of functions: movement up, down, forward and backward – in different steps and/or time-dependent – rotation in different steps as well as a pushbutton at the end of the lever. Infotainment control elements are even more complex: various mechanical switches, touch elements, swipe and wipe functions, pressure-sensitive switches and much more.

In order to implement 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. We design and develop the corresponding driver simulations, suitable for a wide range of requirements and applications. Our “test drivers” are “on duty” 24/7 and reliably and persistently deliver reproducible results.

SAMPLE SOLUTIONS

- Simulation for column tube module and steering column switch
- Simulations for control units with finger/press simulation, among other things:
  - Switch control panels
  - Pressure-sensitive switches
  - Touchscreens
- Simulation with articulated-arm robot for controlling vehicle functions by smartphones (test of motion sensors when smartphone approaches door handle, placing smartphone in vehicle charging tray, etc.)

▲ *Fig.: Finger simulation*



▲ *Fig.: Driver simulation for pressure-sensitive switches*

▲ *Fig.: Driver simulation through articulated-arm robot*

MECHATRONIC SIMULATIONS

In many modern control units, the electronics form a closed unit with actuators and sensors. Test systems thus only have partial access to electrical interfaces and must also access these components mechanically.

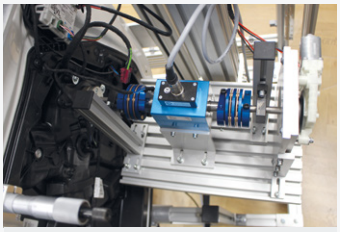
For example, an electric steering system now only has electrical connections for voltage supply and communication interfaces (e.g. CAN, Flex-Ray). All other connections and links are made mechanically: the connection of the steering wheel via a column tube and the connection of the steering motor axle 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.

SAMPLE SOLUTIONS

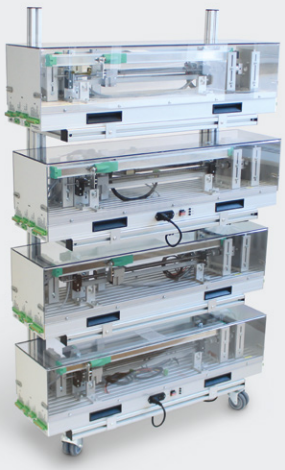
- Simulation for electric steering
- Simulation for electric hand brake
- Simulation for electric rear axle steering
- Simulation for electric brake power assist unit
- and many more

If mechanical interfaces of mechatronic components have to be connected to test systems, we design and develop custom-fit solutions. Whether actuator control by the test system (e.g. with rotary or stroke movements) or conversion of sensor signals into electrically measurable variables (speed, force, pressure, heat, light) – we realize mechatronic simulations for a wide variety of applications.

▲ *Fig.: Traveling distance on window regulator*



▲ *Fig.: Pressure measurement and influence on the window regulator*



▲ *Fig.: Simulation of seat adjusting motors*

ENVIRONMENT SIMULATIONS

Even if the scope and complexity of the simulations used in testing continue to increase at the current rate – many components, such as highly integrated sensors, are already used as production parts in composite tests. As a result, it is now not only a case of simulating electrical signals; physical quantities for sensor stimulation must also be generated. With suitable environment simulations, such sensors can be specifically impacted with

- warmth (temperature sensors),
- light intensity (environment, tunnel),
- refraction of light (rain),
- forces (e.g. torsional forces on the steering wheel, weight on the seat occupancy mat and vehicle load for the chassis),
- pneumatic pressure (door crash sensors, tire pressure)
- hydraulic pressure (chassis),
- rotational movements (wheel speed),
- accelerations (parking bumps) or
- ultrasound (interior monitoring).

In this way, different events can be simulated and the corresponding ECU response or control behavior tested. The requirements in terms of the structure, function and interfaces of an environment simulation are extremely diverse. We are happy to accept the resulting challenges and – with creativity and our many years of experience – develop suitable solutions for your individual test scenarios.

▲ *Fig.: Rain/light simulation*

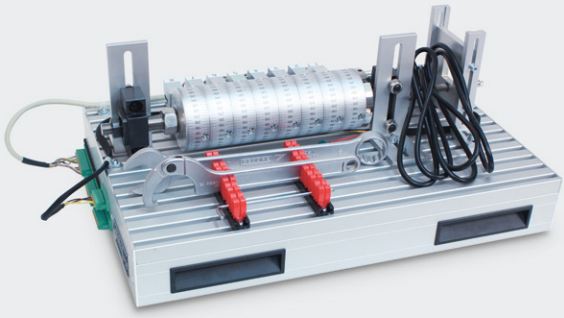
▲ *Fig.: Simulations on a sliding sunroof (referencing stops, blocking on normal travel)*

▲ *Fig.: Wheel speed simulation*

SAMPLE SOLUTIONS

- Rain simulation
- Light simulation
- PTC electric auxiliary heater
- Belt carrier
- Tilt/slide sunroof
- Motor controller for air conditioner box
- Wheel speed simulation

▲ *Fig.: Tests on PTC electric auxiliary heaters*



▲ *Fig.: Simulation of engine stops due to blocking*

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