

Report			
MCD Elektronik GmbH Hoheneichstr. 52 – 75217 Birkenfeld Tel. +49-7231 78405-0 – Fax: +49-7231 78405-10 Managing Director: Bruno Hörter	Release Date: 26.03.2018	Page 1 von 9	
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Probe Head Simulates Human Finger

Hybrid Test Station for 100-Percent Testing of Switch Modules

An automotive supplier generally tests electrical functions of vehicle components but also the look and the haptics of automotive switch modules. Those can be tested f.ex. in a system including four test stations, while a pneumatic handling system gets rid of fail parts automatically. Trends within the production process can already be recognized with the help of the MCD Software Data Manager.

There are several details which are responsible for the car owners' all around comfort, such as the sound of closing doors, the motor or the grip of the steering wheel. The haptics of automotive switches are also important and add value to the described customer feeling as well. Bruno Hörter, CEO and owner of MCD, is very aware of this fact and therefore developed a hybrid system for 100-percent testing of switch modules with his team. Within a really short time frame the customers' aspiring wishes had to be realized. Four month after ordering, the system had to be brought into production. "The development team was able to rely on various MCD standard products to satisfy the demand and as a result, a complex system with exceptional quality fulfilling criteria was created. It combines various test disciplines in form of a rotary switch table arrangement", Bruno Hörter says.

The testing carousel is 1,2 meters wide, 1,2 meters long and stands 2 meters tall. The system measures the automotive switches in a cycle rate of five seconds. Particular attention was paid to check electrical functionality as well as the look and the feel of those switches. On the front of the testing unit the manual insert station is positioned. Exchangeable nests for the DUTs are placed on the rotary table. After the manual insertion of the switches through an operator, they are pneumatically contacted so that the electrical parameters can be measured.

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The second station verifies the switches' assembly capability. On this station, the straightness of the plug pins are tested in form of a mechanical swash circuit inspection. The insertion force of the supported floating connector housings is also measured in this station.

On the third station, the optical test is examined. Here, the look of the switches is put under the loop. Amongst other things, components like illumination, LED color of the symbol on the switch, its position and quality of execution are tested.

A special camera system for light density-measurement and a high-resolution Cognex color-camera system are utilized for the optical test. The functionality and its graphical user interface are integrated into MCD's Imaging Software. In addition, statistical records and results validate and support the documentation of the test results. A special isolation makes sure that the tests are not disturbed by external light.

Station four is the core of the test system – the „haptical check“ with electrical resistance test. Here, the force used for pressing the switch and the conductivity of the electrical contacts are measured. This describes a dual measurement, because the switches are measured on the outward and return path. A probe head takes care of pressing the switches with a motion controller. A mechanical probe thereby simulates a human finger. It proceeds with predefined speed and records the force curve in coordination with the current position. The execution is performed directly in the motion controller. Once the maximum force or a special position is reached, the drive stops and therefore the measurement is finished. After this, the measurement of the return path is examined and an integrated routine takes care of calibration in case of type exchange, reboot or an error occurrence.

Precision sensors and angular encoders record the force curve during the haptical check. For the force measurement, the MCD team selected a robust

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piezoelectric force sensor, which is specially designed for measuring rapid changing compressive forces with a maximum of 50 N. Parallel to the force measurement, the definition of switching points of a 4-pin resistance measurement with a high-precision milliohmmeter takes place. All physical measured values like force, displacement and resistance curves (coding resistance) as well as switching points are recorded and evaluated simultaneously.

Envelopes define the areas where the measurement curve has to run through as well as areas that should not be touched. If the measured curve doesn't match with the pre-selected area, the DUT gets evaluated as a fail. The actually measured curve of a golden device can be chosen as a reference curve. The evaluation either takes place separately or together for the outward and return path. Test results, statistical records and evaluations are analysed with an in-house MCD solution, the Graphical Analysis Toolmonitor.

In station five, the automotive switches are marked on this test system. A laser marks the OK-parts with customer-specific data. Not-OK-parts receive an error code.


The Data Manager plays an important role here. This software collects and combines all measured data of every test station and creates an own data set for each DUT. For manual or automatical evaluation, extensive statistical and analytical functions are available for users. This includes information about test time, error statistics (frequency, distribution), statistic of measured values (distribution, variance in accordance to sigma evaluations) as well as the analysis of machine and process capability. The user can also add own evaluations to project files. Integrated report modules take care of the export in superordinate evaluation systems in various formats (Word, Excel, PDF, text, XML, HTML and so on). The integrated script engine automatically creates and saves all evaluations and reports. All necessary functions are

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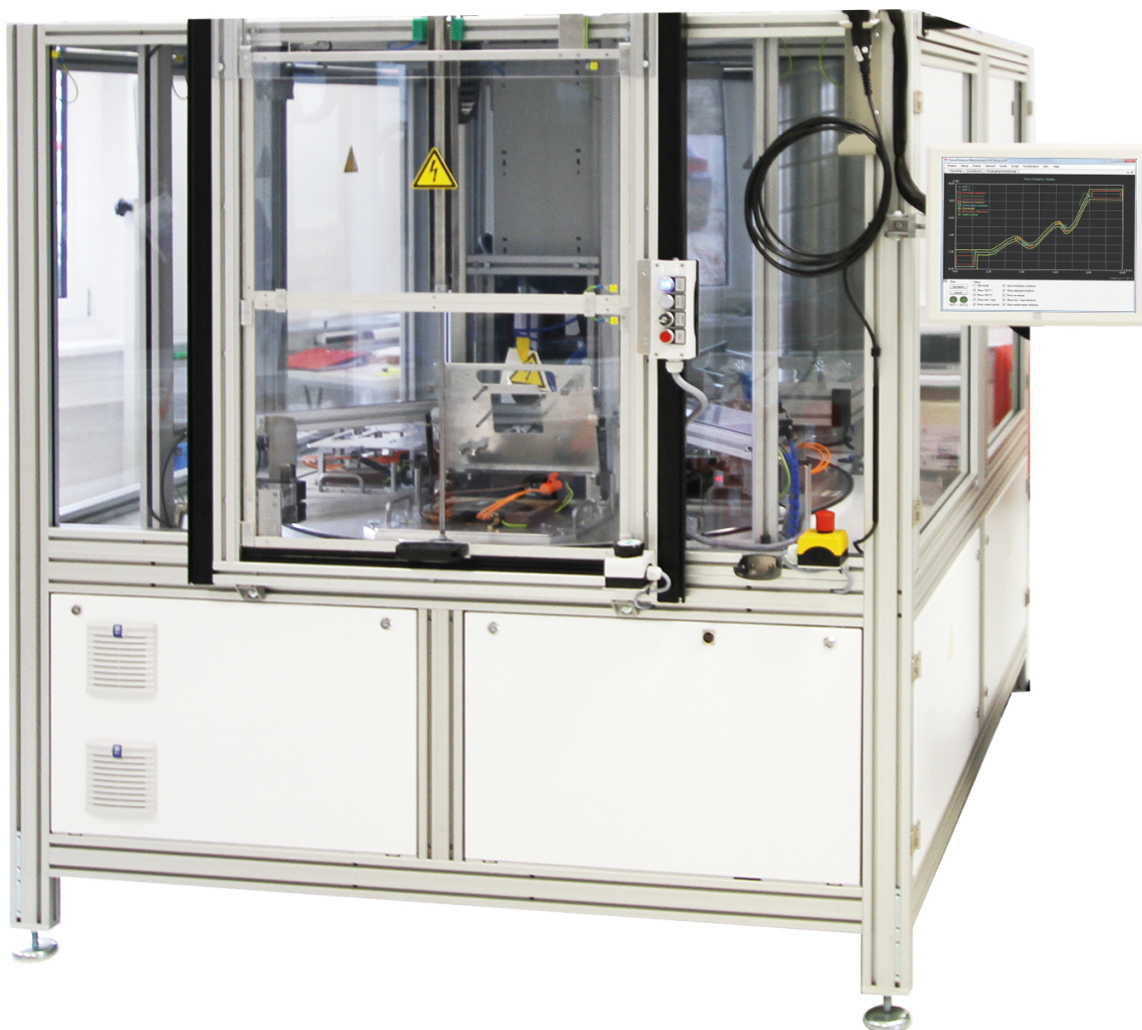
available in form of web reports and are utilized for the IT system for transfer and reception of necessary data.

Significant for the production management is the integrated trend analysis within MCD's Data Manager. This fact helps to recognize changes concerning the stability early on. If measured values are drifting more and more to undefined areas, this indicates that tolerances of components or system malfunctions occurred. Due to this, possible production interruptions can be prevented in advance.


The operator doesn't need to manually take care of error parts. A pneumatic handling system in the final station of the system sorts them in a faulty container.

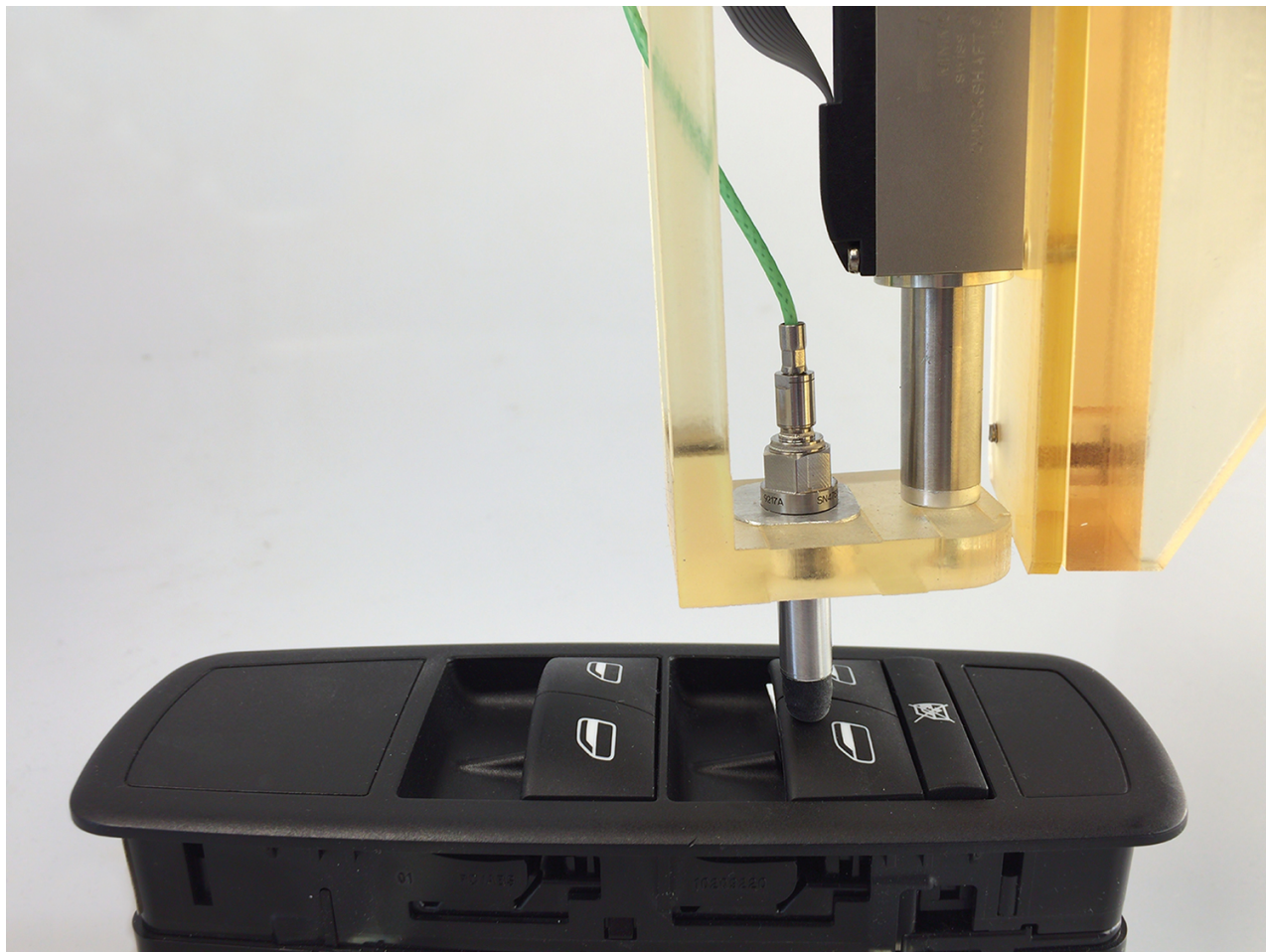
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Pictures:




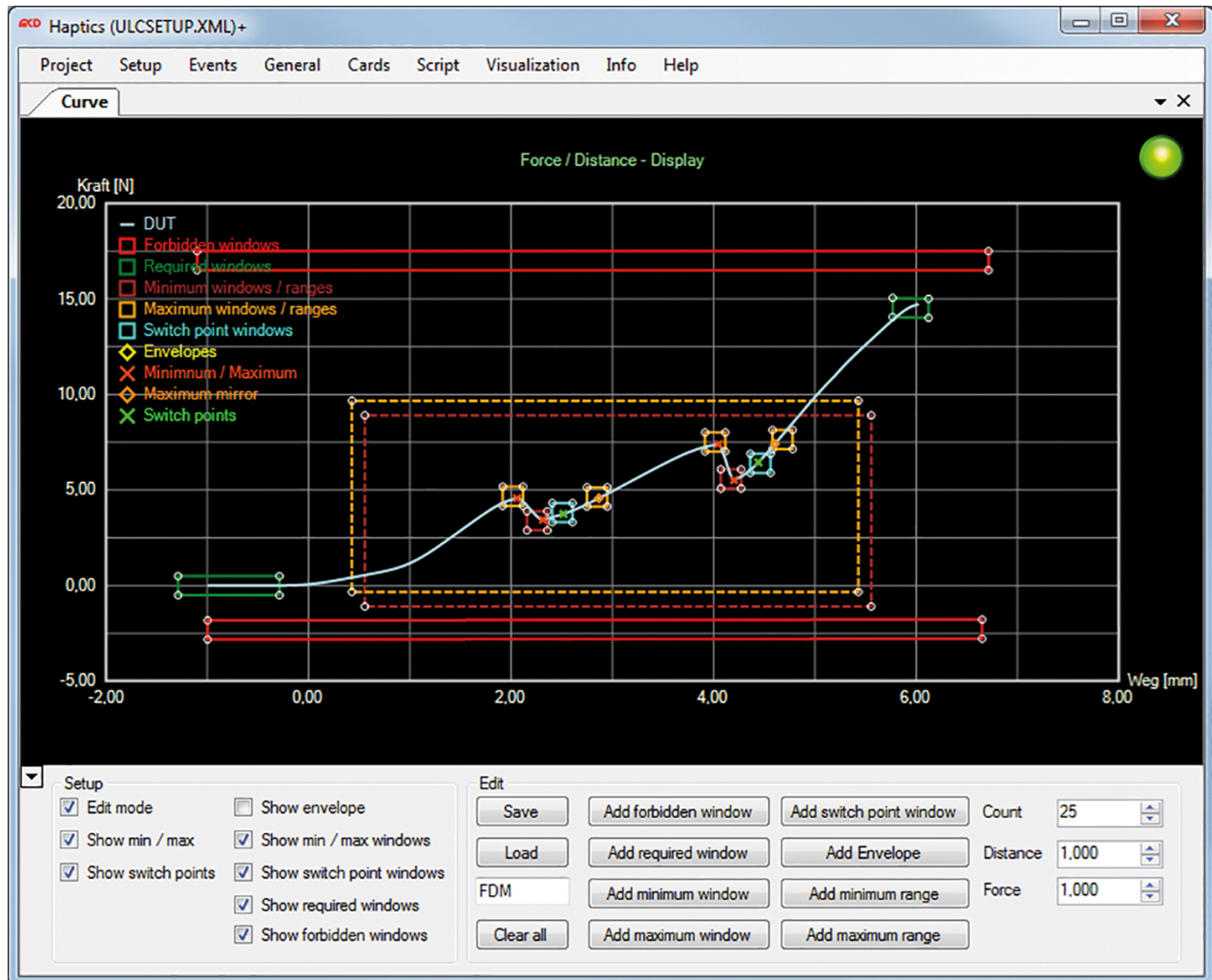
Picture 1: This test system for automotive switches was realized within a record 4 months.

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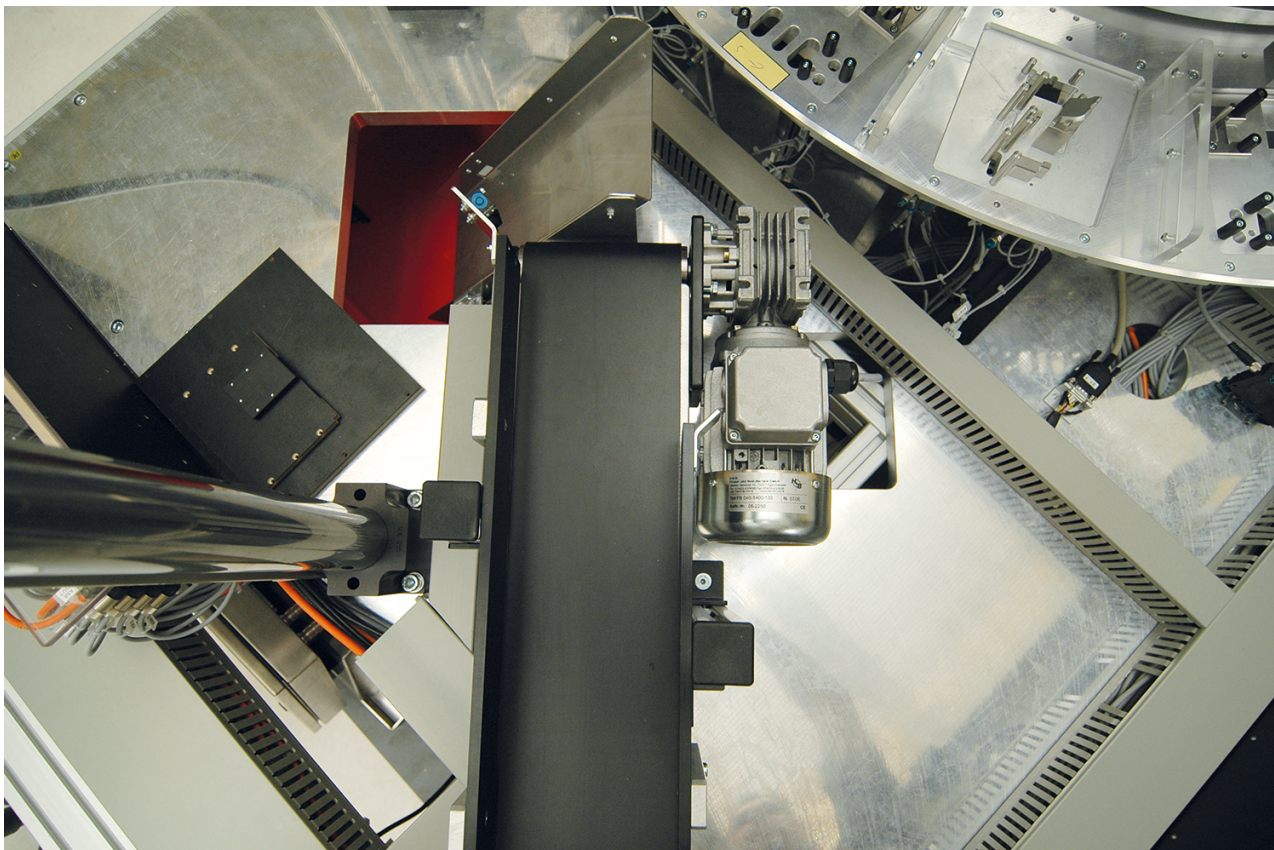
Picture 2: Example of a haptic check of automotive switches with a 3D-printed fixture.

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Picture 3: Force measurement of a switch. The markers show the switching points. The interference impulses and the background noise of the production environment are filtered through a low-pass.

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Picture 4: NOK parts are dropped in the red container. OK parts are positioned on the transfer belt.


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About MCD Elektronik GmbH:

MCD Elektronik GmbH was founded in 1983 and currently employs 80 people. The owner-managed company is headquartered in Birkenfeld, near Pforzheim, Germany. MCD Elektronik is active in Germany, Hungary, and China, and delivers to 48 countries around the world.

MCD Elektronik GmbH manufactures measurement and test systems for electronic production for their customers, who include OEMs and their suppliers in the automotive sector, companies in machine and systems design, medical technology, energy-electronics, quality technology, sensor

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manufacturing, and aerospace. The company relies on innovative customer-specific complete solutions - developed and realized by a team of highly qualified specialists.