


Report			 ELEKTRONIK GMBH
MCD Elektronik GmbH Hoheneichstr. 52 – 75217 Birkenfeld Tel. +49-7231 78405-0 – Fax: +49-7231 78405-10 Managing Director: Bruno Hörter	Release Date: 16.04.2018	Page 1 von 8	
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For immediate publication	Queries to: Verena Hörter, Verena.Hoerter@mcd-elektronik.de		


Everything Under Control

Robotics Toolmonitor Facilitates Conception of EOL Test Systems

A well-known supplier from the automotive industry searched for an universal solution to test various switches which are located in the cockpit of the car. These include buttons, rocker switches as well as rotary switches. The fields of application are rather different. Sometimes it is about testing easy things like on-/off-functions, power window switches or even rotary switches with multiple positions and different electronic contacts and potentiometers. An on-/off-button has only one threshold whereas power window switches have a car-specific pressure- and traction function. Furthermore, on diverse buttons as well as power window switches, the rocker switch is not pushed on axis but in a circular path. The task was to test everything, the haptic, the lighting of the switches as well as their electrical function. Obviously, the test system should be adaptable to the switches of different manufacturers and car models.

1. Vehicle Switches in Endurance Test

The german measurement company MCD Elektronik is specialized for the construction of such test systems and got the contract for the conception of an EOL test line. It was decided that the system should consist of five stations and two robot cells as a special feature. In these stations with the 6-axis articulated robots, the rotary switches of panels for light and climate systems are examined. These are supplemented by two AOI (Automated Optical Inspection) test stations which examine the symbols on the DUTs via high-resolution color cameras. The fifth station is designed to test the power window modules. Here, the rotary actuation, resistance and torque measurements are analyzed. The panel in the test cell is contacted automatically and tested functionally. MCD's CEO Bruno Hörter: „In the optical and haptical inspection we could rely on proven solutions. The rotative test of rotary switches with a robot was new territory.“

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The customer defined the use of Mitsubishi Type Melfa RV 4FLM D for the robot cells. The manufacturer delivers an universal control software with it but it does not fit optimally on test areas. Either way, the goal in this project was to design an easy and consistent user interface. This fact motivated MCD to develop an own solution for the control of the robots. The choice at MCD was to program the software based on its own software platform „MCD Toolmonitor“. The result is an application-specific version of this program, the „Robotics Toolmonitor“. The software helps and enables not only the control of the Mitsubishi robot but also other robot types, XYZ axes or combinations of both as they are common in the electronic production.

2. „We Understand Robots“

With the Robotics Toolmonitor, the test station has a consistent user interface. Via the interface, the axes can be operated manually, robot positions can be preset and learned. So-called snapshots record important positions which are driven individually or sequentially. Due to the integration of multiple, strung together snapshots, one receives a more efficient program flow, because the complex transfer of the program memory lapses.

Robot gripper arms are a final element of the kinematic chain. Those are opened, closed and moved along the axes with the help of the Toolmonitor. The Robotics Toolmonitor allows the control of ball, rotation, torsion and linear joints as well as platforms and gripper arms. The program fits in overreaching third-party software via a COM/DCOM interface or a net assembly. This facilitates the integration in multiple applications, like Microsoft Visual Studio (C#, C++, Visual Basic), Microsoft Office (i.e. Excel), Open Office, LabView or MCD TestManager CE.

For the rotary actuation and haptic test including force-displacement measurement, several MCD programs work together. The functions of the Robotics Toolmonitor are supplemented with the TestManager CE and the Graphical Analysis Toolmonitor.

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3. Everything Needs to be Examined

During the measurements not only the haptic and imaging tasks are carried out. The complete functional check via LIN buses of the DUTs follows. The functional test captures all points, which are specifically relevant to such panels, such as current, voltage, switching resistance, distance, time, tensions, codes, switching points synchronous to actuation, snap-in points of rotary knobs, presence of contacts, transition resistances and many more.

The stations 3 and 4 are controlled by the MCD Vision Toolmonitor. Here, operating elements like main light switches and climate control devices are optically inspected. The switch illumination, day and night design as well as position recognition of the symbols in relation to reference points are examined. The optical test also includes the check of the LED color and brightness of the background and functional lighting. After the measurement follows an automatic comparison and calibration of the LED lighting. In addition to that, a short-circuit test is executed and the current consumption is measured.

In the fifth station, the panels for power window modules (driver, co-driver) are examined. The test station checks the electric function, short-circuit, connection test as well as standby current and active power test. For the CDDC module test, a LIN master automotive interface is available. The DDC and RDC modules test is performed with resistance determination via multimeter and ULC measurement board. A mechanical swash circuit inspection on all contact pins takes place before each contacting.

The power window switches are actuated with an electromotive-driven finger. Furthermore, the station measures torques, rotation angles, forces, distance, resistance curves during outward and return records and evaluation (via LIN bus or analog).

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4. A Glance at the Whole

The MCD Data Manager is finally responsible for the evaluation of test results, statistical recordings and evaluations. Trends concerning measured values are identified, so that deviations and interruptions can be recognized before they even occur.

The complete line is connected and all data comes together in a central point. A SQL connection for the measurement data acquisition exists. All parameters and settings can be changed and retrieved via an own higher-level control. Here, the user defines the whole work flow and the test specifications. Bruno Hörter: „As a special feature we integrated a self-developed Manufacturing Execution System, MES. With this, all systems can be administered centrally in the line and can be adjusted consistently to new types, variants or DUTs for future purposes. The MES was developed and implemented individually according to customers wishes and demands. The whole thing ensures optimized quality with an increase of productivity at the same time.“


Some questions to ask MCD’s CEO Bruno Hörter

Question: Mr. Hörter, MCD is a recognised and successful specialist for measurement technology. Do you now compete with robot specialists?

Hörter: I wouldn’t say that. Our competence clearly lies in the field of measurement technology. In the last years, however, we developed a significant potential of really useful software tools. This includes the MCD Toolmonitor series. Today we have more than 20 special versions of it, including the Robotics Toolmonitor.

Question: Why this excursion into new and foreign territories?

Hörter: The customer „ONLY“ wanted a known interface to control those high complex tasks. All variants of the Toolmonitor are based on the same

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programming environment and have the same user interface. Therefore, nobody needs to learn the strings of external controls.

Question: Does the Robotics Toolmonitor fit the needs of conventional requirements to a robot control?

Hörter: Definitely. The Mitsubishi PLC has all the relevant safety parts stored in it and therefore ensures the safety technology. Our PLC is located inside this secured area. All movements can be simulated on the test surface, even without a connected control and robot. This simplifies the use and the set up for the operator.

Question: How dependent is the product on its specific and original application of your customer?

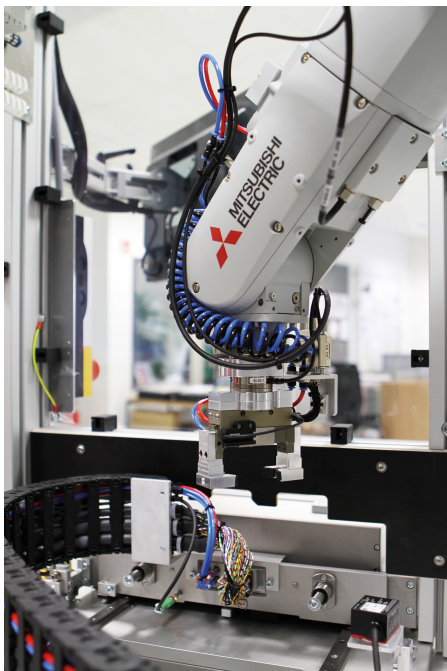
Hörter: We paid attention from the beginning, that this product can be used universally for robots and axes systems in test and assembly areas. The Toolmonitor can be implemented to control different robots and axes and the installation and commissioning of new types can be taught and implemented easily.

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Pictures:




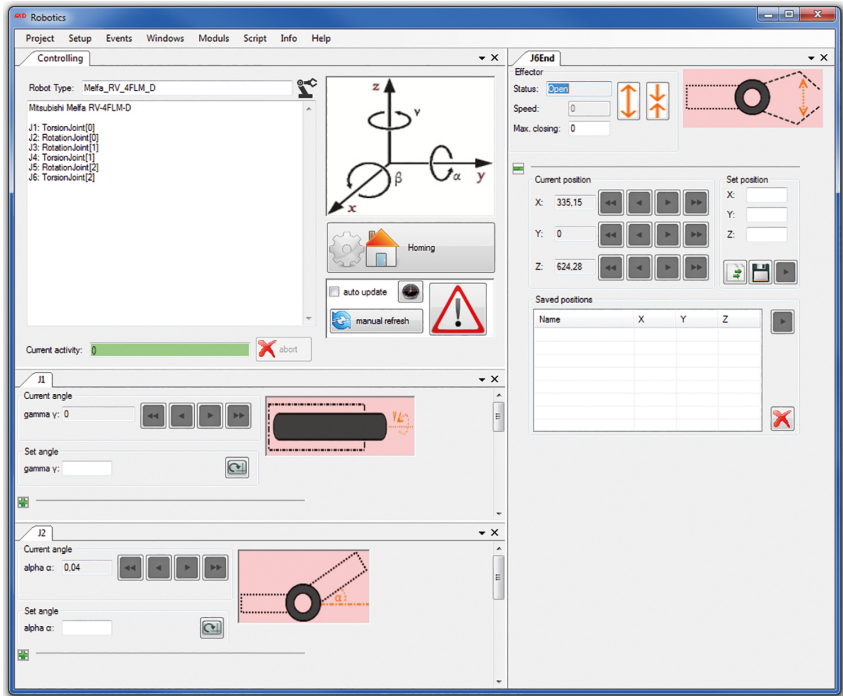
Picture 1: The test cell with a 6-axis robot for rotative test of rotary switches on the left, the station for examination of power window modules in the middle and the AOI station on the right.



Picture 2: For the actuation of rotary switches, the robot is equipped with a pneumatic gripper.

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Picture 3: The user interface of the Robotics Toolmonitor



Picture 4: The system for automated optical inspection (AOI)

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