A Clear View of the Future

Early Trend Recognition with the MCD Data Manager

Effective quality control needs a customized test strategy. Only perfect products should leave the factory for the customer. However, it would be a missed opportunity to limit the testing of components and products to a mere yes-or-no decision, because test equipment for a function test or end-of-line test usually delivers more than just a ‘pass’ or ‘fail’ – it can also supply an abundance of other useful data.

These data constitute valuable material for production managers. Measured currents and voltages give direct indications of the behavior of electric and electronic components like capacitors, coils and resistors, and they supply information about the behavior of other components – such as the power consumption of an electric motor, which can provide indications, for instance, about the condition of its bearing. Or the time taken by a heating unit to reach a specified temperature can be taken as an indicator of its functionality.

1. Looking Ahead

From the measurement and recording of specific physical parameters, test planners draw conclusions about the functional capability of the test samples. One aspect of interest is to recognize changes early on. The slow drifting-off of measured values, for example, can be so minimal to begin with that the test object passes as satisfactory. However, the extrapolation of trends of this kind may be evidence of undesirable developments. Incidentally, this applies not only to the test objects, but also to the test equipment itself.

The gradual drift of an important parameter may be an indication of a fault in material or production. However, it is equally possible that in the testing unit itself, undesirable changes may be taking place which are detrimental to the test results.

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Test activities produce enormous quantities of data. Many test operators try to tame the data flood with self-generated Excel charts. The analyses – whose quality depends greatly on the talent of the generator – have the disadvantage that they do not run parallel to the measurements, but always constitute a “backward look”. Thanks to its own practical experience, metrology specialist MCD Elektronik recognized this problem very early on and developed a software tool, the “MCD Data Manager”. Originally designed as an additional module for its own in-house development, the MCD TestManager CE, today the MCD Data Manager is a powerful tool, useful to all test engineers and their colleagues in production.

2. Considering the User

The Data Manager (see Picture 1) can be operated in direct combination with the TestManager. However, its numerous interfaces mean that it can also be operated in other test environments. The program analyzes measured values and generates statistics and reports. Thanks to the use of a fast real-time database, the analysis of the measured data is available almost in real time, after a brief processing time. Analysis can be either user-controlled or automatic. A wide range of filter functions allow the data material to be viewed from different perspectives. In addition, an SQL interface gives direct access to the data material, thus also making it possible to implement non-standardized, user-specific queries and analyses.

The most important statistical analyses performed by the MCD Data Manager include:

- Statistics of test results and test duration
- Fault statistics (frequency/distribution)
- Statistics of the measured values (distribution/variance)
- Analysis of the machines and process capability (according to customer’s algorithms)

The integrated Report Module supports the user in generating his own analyses. These are stored in project files and can be uploaded at any time. For

most firms, it is important to be able to adapt the appearance of reports freely to the company's own specifications, including the company logo. Export to superordinate management systems is also possible; various formats such as Word, Excel, PDF, Text, XML, HTML and many more are available for this. Conversely, the MCD Data Manager can also be completely remotely controlled by software from an external software system. An integrated script engine enables all analyses and reports to be automatically generated and stored. The data can also be made available as WEB reports at online-workplaces as required.

Different situations call for special views of the data. For this purpose, the MCD Data Manager offers various filters, including serial number of the device under test (DUT), test mode, test duration, or a specific time window. The results are presented in list form, but can also be displayed in graphs with various parameters, e.g. "Top Errors" (see Picture 2).

3. Early Problem Diagnosis

As well as the availability of currently measured data, in most cases "trend analysis" offers a reliable look at the future. For this, the MCD Data Manager calculates a key trend indicator using statistical algorithms. An indicator of this kind clearly shows a development / change in the production process or the test process. In this way, an undesirable alteration in the test object can be anticipated and prevented.

However, the problem may often lie in the test procedure itself, as shown by the example of the production of flap regulators. An automotive supplier was having more rejections than usual. The reason for these problems could not be identified using the Excel database analysis. Analysis with the MCD Data Manager, using the graph of measured values and statistical / trend analysis, pinpointed the angular error straight away. The trend only became visible in the graphic representation of the shift in average value of the angle meas-

urement. The cause for this error was not in the test object itself, but in the mechanical displacement of the DUT holder.

Marcel Bräuninger, responsible for software production management at MCD, explains: “Trend analysis makes it possible to react by correcting the production process or the test equipment before DUTs are rejected. Thus machine downtimes and high rejection rates can be avoided before they occur.”

For trend analysis of the recorded values, statistical evaluation and filtering of the individual measurements takes place first. Thus for the trend calculation, only DUTs are analyzed which tested as PASS (“golden devices”), in order not to distort the relevant trend by actual faults. Trend analysis can be focused on freely adjustable areas and different areas can be compared.

These areas may be:

- Production as a whole
- Differentiation between individual plants
- Differentiation between types of devices
- Differentiation between time periods
- Differentiation between different lots
- Differentiation between different batches of production material

The trend analysis itself is performed by a weighted approximation of the measured values. Here, the time when the measurement was taken, the deviation from the desired value or the average value, and of course the scattering of the individual measured values play a central role. The algorithm used then recognizes whether – and if so, when – a production run goes outside the limit values that have been set.

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4. Many Uses in Daily Testing

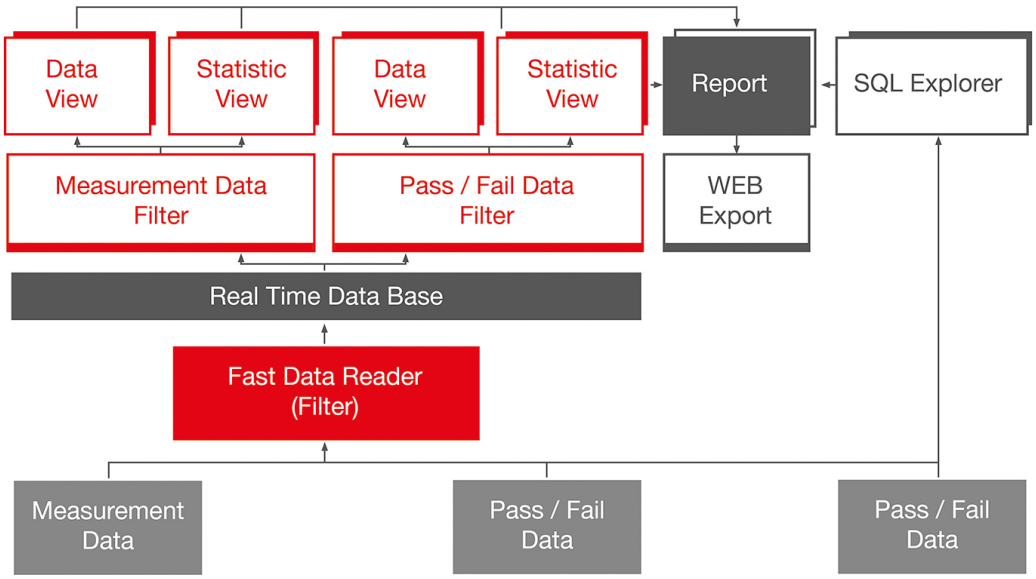
There were good experiences with the optical swash inspection testing of contact pins. This test checks whether the contact pins of a test item are bent. For this purpose, the distance between the tip of the pin and a reference point is measured and the measured value is stored in the database.

During the commissioning of test equipment, analysis of the database by the MCD Data Manager was very helpful. With the help of statistical evaluation (normal distribution), it was possible to analyze the distribution of the measured values, and thus the degree of precision achieved. On the other hand, the trend analysis function was helpful in determining and testing the stability of the values. The early diagnosis of “drifting” values was a very important criterion during commissioning, in order to ensure the stability of mechanical contact with the DUT.

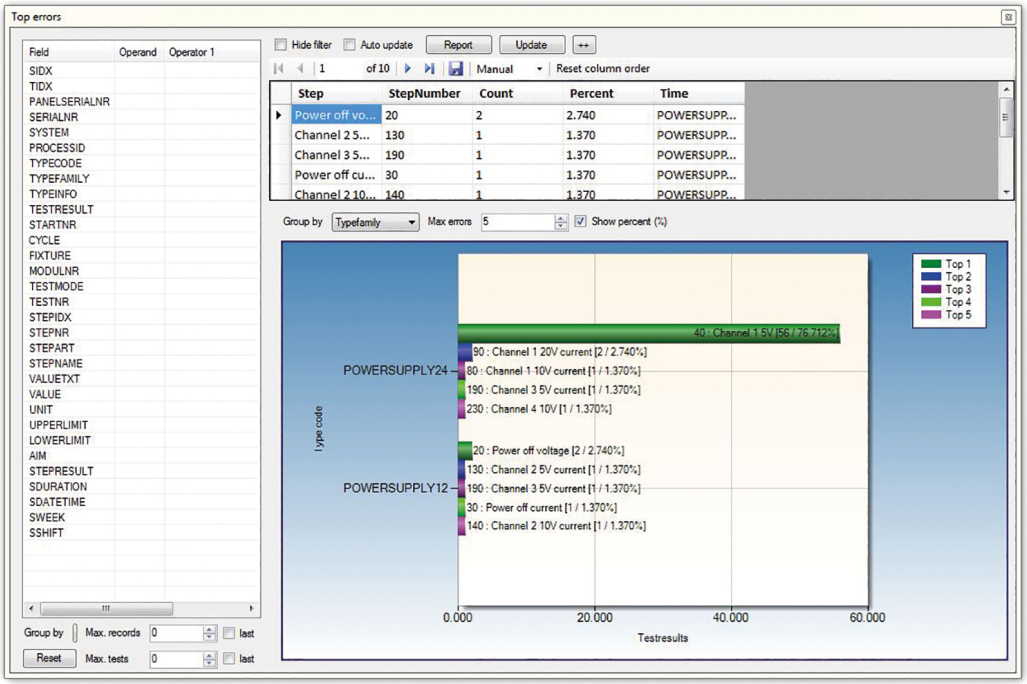
One useful feature of the MCD Data Manager was the graphic display of the normal distribution in the statistical tool. Another advantage when using the MCD Data Manager is the fast data transfer from the database of the MCD TestManager, which was also used in this case.

As well as pure trend analysis, statistical comparison (sometimes including parameters which may at first seem unrelated) also plays a decisive role in the optimization of a production line. For this, the Data Manager offers the possibility of comparing measured values, automatically optimizing the limit values for a measuring point, and simulating the effects this has on production as a whole. Thus by using the Data Manager in the production of audio amplifiers and optimizing several tolerances at the inline testing stage (i.e. before final assembly), it was possible to reduce the end-of-line (EOL) failure rate by 20 %.

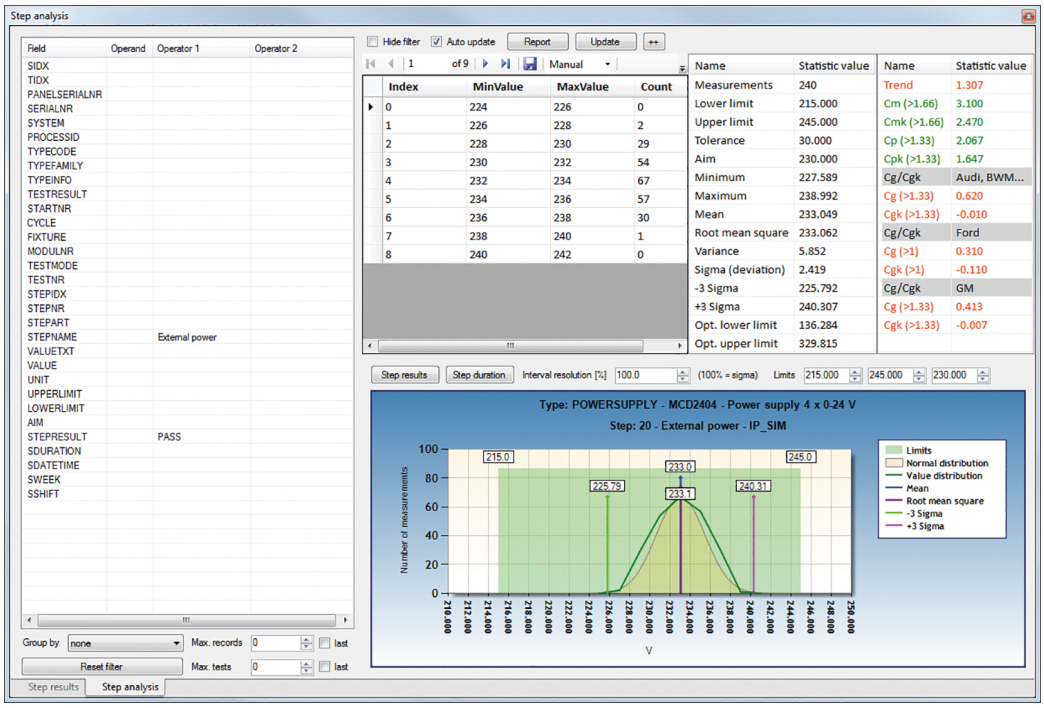
Pictures:



Picture 1: System architecture of the MCD Data Manager



Picture 2: Graphic representation of “Top Errors”



Picture 3: Analysis of drifting values

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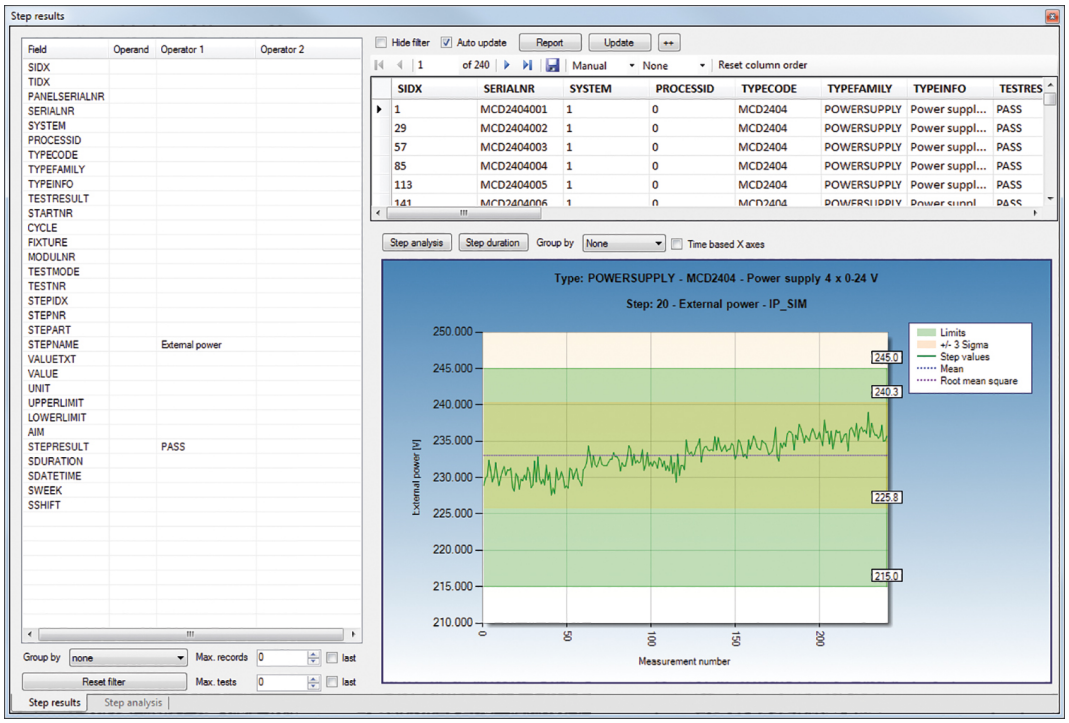

Picture 4: Display of trend of drifting measured values

Picture 5: Testing equipment makes the decision “pass” or “fail”. The MCD Data Manager helps confirm the reliability of the recorded data.

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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 de-

sign, 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.

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