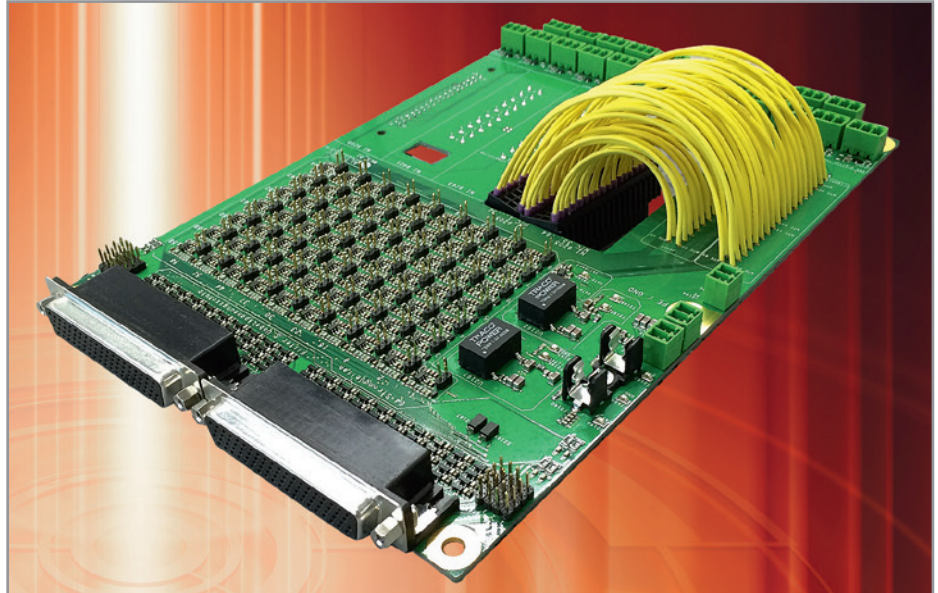


# Sensor Test System



64 channel sensor test system

## 64 Channel LabView test system

The team of electronics engineers at Altatec develops test systems for customers as well as for their internal assembly lines. A wide range of technologies are used. PCB design, mechanic design, FPGA programming, micro-controller programming, and application programming with Python, C# or LabView are only a few examples.

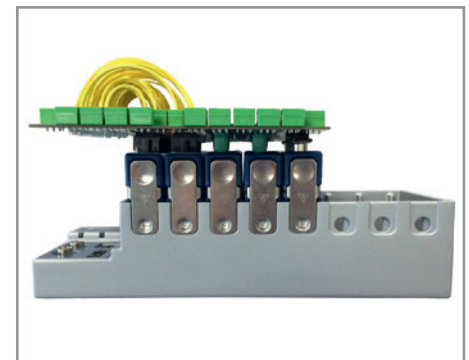
Goal of the project was to build an automated test system for sensors. The electrical resistance of 64 sensors have to be measured under different conditions. All 64 sensors have to be measured simultaneously 10 times per second with an accuracy of +/- 0.1 % at 10 kOhm.

Two displays show the state of test cycle and test results, which are stored in form of an Excel sheet. LabView was used to program the application and a National Instruments cDAQ-9188 was predefined by the customer.

The requirements could not be met with the given hardware, so an application-specific solution had to be developed. 64 individual current sources and 64 voltage measurement channels with additional input and output channels were implemented on a multilayer PCB.

The mechanical design of the board and the position of the connectors have been designed so the board can be mounted directly on the cDAQ-9188. This enables to saving space and costs and increased the signal quality by shortening the cable length.

Many details had to be considered to achieve the high accuracy, such as the temperature coefficient of the 64 current sources. Only few operational amplifiers are suitable and precision resistors are used. Special care was also required for routing geometry and the impedance of signal traces.



PCB mounted on LabView application



Altatec in Steinhausen, Switzerland



Reto Müller, Electrical Engineer

## Design challenges

The biggest challenge was to reach the high precision of +/- 0.1% at 10kOhm. 64 adjustable current sources were implemented in order to meet this demand. Each current source can be calibrated automatically. 4-wire measurement was not an option because of the high number of channels.

Strong electromagnetic interferences caused by welding processes located next to the test system were detected by Altatec at an EMC test in the start phase of the project. Adapted hardware and software filter solved this problem.

A special PCB design was used to reduce the number of connectors and cables. The printed circuit board was designed in a par-

ticular way that the NI cDAQ can be connected directly to this 4-layer PCB.

## Tools used to design the hardware

Altatec uses OrCAD Capture and OrCAD PCB Editor with the Constraint Manager. "Hierarchical blocks of Capture and Design Reuse of the PCB Editor where key functions in this project" said Reto Müller, Electrical Engineer at Altatec. "They supported me by implementing 64 identical layout blocks. I could focus on the essential part of the layout and was not tasked by copying schematics or layouts."

The design has many design rules for spacing and impedances. Managing rules in a hierarchical Constraint Manager helped to manage the amount of rules in a clear and structured way.

A systematic numbering of the parts in Capture is important to end up in a well-structured schematic and bill of material. The option to define number-ranges for components within a hierarchical block was a great help to implement this in an elegant way. The function "Design Reuse" was easy to use, and the 64 current sources could be implemented without errors in a short amount of time. Importing of mechanical drawings helped to place the connectors to the correct position in order to fit to the NI cDAQ.

A very important factor in general is the competent support by FlowCAD. This enables Altatec to use new functions in a very short time and solutions can be found without running in circles.

## LabView Software

An event driven state machine is used as the main structure. A calibration file which is generated automatically by an additional LabView program is used to adjust all 64 channels. The settings are stored in a recipe file. This allows the customer to test different sensor types with the test system.

Test results are saved as Excel and text files on the server. The files are saved local if the server is not available and copied automatically to the server as soon as possible.

## About Altatec Microtechnologies AG

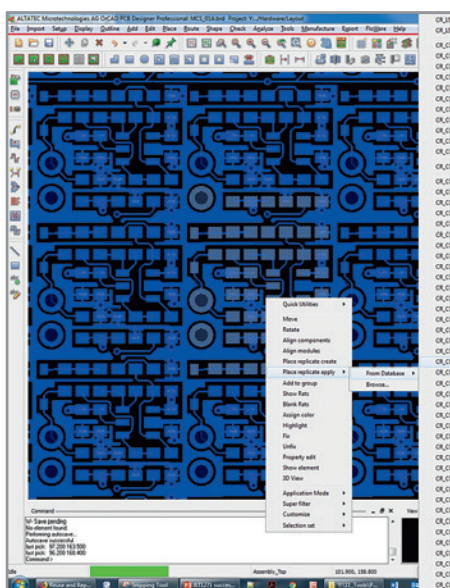
Altatec is a leading specialist in development and manufacturing of innovative, high quality microelectronic solutions.

Thanks to their experience in analogue, digital and microsystems technology, they are now the preferred business partner for many national and international customers. The company is located in Steinhausen and possesses a cleanroom of 300 m<sup>2</sup>.

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Function Design Reuse was a great help at implementation of the 64 identical current sources