OMICRON

FlowCAD

Signal Analyzer

DANEO 400 is a hybrid measurement system suitable for a variety of tasks in electrical substations

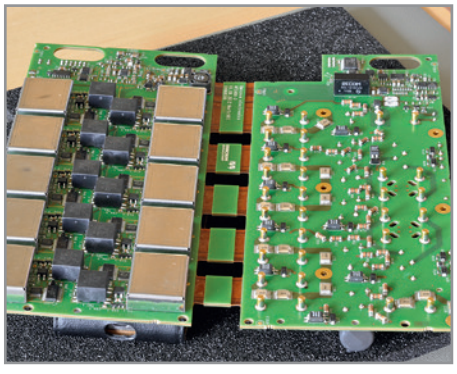
DANEO 400

DANEO 400 is a hybrid measurement system for power utility automation systems. The device records and analyses all conventional signals (voltages, currents, hard wired binary status signals) and messages on the communication network in a substation. It measures simultaneously signals from both of these worlds and can provide information to assess their proper coordination. With this device you can easily keep track of what is going on in the substation by obtaining information on the operational status and communication.

Multiple DANEO 400 units can operate in parallel and obtain a time aligned view on signals covering the entire scope of a distributed SAS. The control can be safely performed over the substation communication network without impairing the function of the Substation Automation System (SAS). DANEO control is PC-based software for configuring a distributed measurement setup with multiple DANEO devices.

The occurrence of malfunctions in substation automation systems is often not predictable. For this reason, DANEO 400 works autonomously and detects trigger conditions on its own for recording signals and network traffic.

The DANEO 400 has many different interfaces. For network and control communication in total 3 Ethernet ports 10/100/1000 Base-TX (RJ45). USB 3.0 is for connection external storage devices. USB 2.0 is a control port to connect the DANEO with the PC as alternative to the ETH port. As extension ports 2 EtherCAT® ports (RJ45). For signal measurement 10 analog or binary inputs with a sampling frequency of 10 kHz or 40 kHz (nominal ranges 10 mV, 100 mV, 1 V, 10 V, 100 V, 600 V) and binary level detection potential-free contacts or DC voltage. As well as an internal storage on a Solid-State-Disc (SSD/60 GB).



Top view of the analog flex board with about 25x25 cm when unfolded

Omicron Headquarters in Klaus, Austria

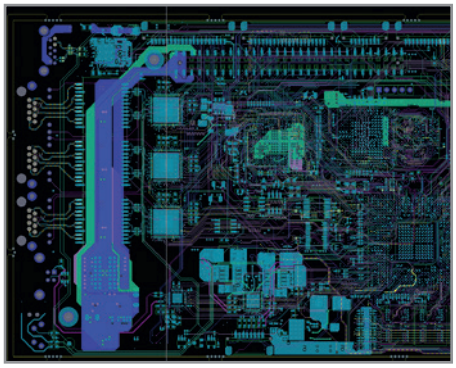
Robert Ammann, Senior Hardware Development Engineer

Design Challenges

"OMICRON is known for reliable products with high accuracy around electrical energy that allow power systems to run smoothly, safely and efficiently. The printed circuit boards within our products have to be very reliable across a broad range of voltages and currents. Safety for our end-users is a main topic beside future-proof aspects: smaller, lighter, smarter", said Robert Ammann, Senior Hardware Development Engineer at Omicron electronics GmbH.

The inputs are connected with an analog digital converter for precise measurement. Functionality and parasitic effects of these analog circuits were simulated and optimized with PSpice to predict a linear behavior and accurate data capture.

Multiple standard interfaces with different design rules are challenging while being routed with high voltages and high currents on the measurement side of the PCB. Several spacing rules for various netgroups are managed in the Constraint Manager. But also, all electrical rules like length, minimum length, impedance, and differential pair spacing for digital data transfer or storage were applied as a constraint set for each interface.



View of complex PCB layout

With more than 1300 components on a 12-layer PCB the layout is dense and the formfactor is adding complexity to the design task. Online design rule checks helped to respect all constraints and build a design following all design rules for power and high-speed. The rules have to be compliant with IEC standards for electrical power systems.

"Our products are intensively used all over the world and sometimes in very remote locations, so reliability is a key feature. Reliability has to be designed in the product, it does not come for granted", said Ammann. "With OrCAD Sigrity ERC the design was screened for impedance continuity and parallelism of traces to minimize reflections and crosstalk. Optimal coverage of PCB space within a housing gets a best feasible size of our devices. Therefore, we use the 3D IDX and STEP interface between Allegro and our 3D mCAD system. The ERC analysis shows the hotspots for possible violations and the designer can optimize them one at a time when there is enough space around."

The stackup was a challenge, because it was made for rigid flex, impedance routing and high-power nets on one PCB. Omicron has added STEP models in their PCB library. The rigid flex was folded in the 3D canvas to verify that there will be no collisions. Testing was partially made with boundary scan. Already at the schematic level the XJTAG DFT Assistant for OrCAD Capture helped to see the test coverage and reduce the number of test points in the design.

Tools Used to Design

Omicron uses the scalable Cadence PCB Solution with Allegro Design Authoring and Allegro for PCB Design. To simulate analog circuits PSpice was used to predict functionality, stress, and yield of components. To enhance signal integrity and crosstalk for a PCB with traces width of 100 µm and min spacing of 100 µm Sigrity ERC screening was performed. The number of test points was optimized with XJTAG trough the integrated OrCAD Capture interface.

About Omicron

Omicron has its headquarters in Klaus, Austria, close to the border of Switzerland. Omicron has grown from a small group of dedicated engineers into an international company with 24 offices worldwide and customers in over 160 countries.
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