S U C C E S S S T O R Y

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E3.series®

Zuken's software solution for electrical wiring, control systems and fluid engineering.

Bruker raises documentation quality and design flow efficiency for precision instrumentation by implementing a modular, scalable CAD system

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"We are delighted with the support provided by Zuken and the same applies to the ongoing development of the system. Capabilities that were only a dream five years ago have now become reality."

Matthias Binkele,
Bruker AXS

Bruker raises documentation quality and design flow efficiency for precision instrumentation by implementing a modular, scalable CAD system

To improve the quality of its electrical documents such as wiring diagrams, and to raise its design efficiency, Bruker AXS GmbH Karlsruhe implemented Zuken's E³.series at all stages. The manufacturer of X-ray analysis systems uses E³.series from concept and production to service.

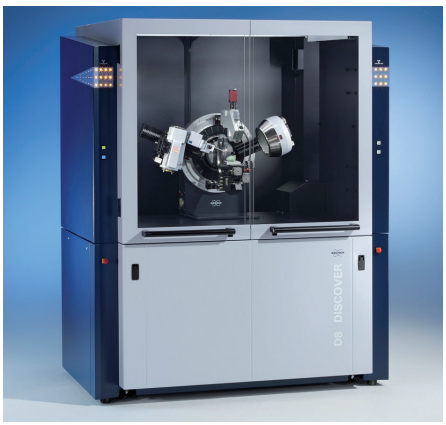
X-ray analysis systems, such as those produced by Bruker AXS, are used for material investigations in labs, material research, and even industrial manufacturing control. *"Bruker AXS is one of the world's leading manufacturers of X-ray spectrometers for element and microanalysis, diffractometers for material analysis, and single-crystal diffractometers for analyzing chemical and biological molecular structures,"* explains Jürgen Fink, head of the Electronics development department in Karlsruhe.

X-ray analysis devices are very complex mechatronic systems with high and very high levels of accuracy. *"The quality of our X-ray analysis devices lies in their mechanical precision,"* says Fink. To achieve the required analytical detection accuracy, the core components of the systems must be positioned using a motor to a degree of reproducibility in the order of a few 1/10,000s of a degree. One of the ways in which Bruker AXS achieves such extreme precision is by using in-house mechanical production.

Other challenges include generating X-ray radiation and the safety precautions this requires, defining the path of the X-ray with a wide range of optical components, and detecting the X-ray emissions are excited or bent by the material samples being investigated. Bruker AXS provides a wide range of 0D, 1D, and 2D X-ray detectors for this purpose. Moreover, samples can be analyzed automatically and linked to generic laboratory automation solutions.

It is easy to imagine the functions that the harness must perform so that all device parts, motors, switches, sensors, interlocks, etc. function intelligently and optimally. The electrical design needed is very different than that needed for control cabinet construction, and is also not comparable with the cable harness design used in the automotive industry. A new approach is therefore needed.

In order to describe and model such complete systems at all levels ~~for~~ powerful CAD and/or ECAD systems are needed. Bruker AXS uses SolidWorks in its mechanical design department and has installed around 15 E³.series workstations in the electrical design department.



The Bruker AXS D8 DISCOVER X-ray diffractometer analyzes the inner structures of materials.

Results

- Noticeable increase in productivity since the time taken to develop an initial sample has been slashed.
- Automated production of manufacturing drawings from wiring drawings for individual connection cables significantly increased design efficiency.
- Improved quality of wiring and manufacturing drawings

BRUKER

For the past 50 years Bruker has pursued one goal: to provide the best technological solution for any analytical task.

Today, more than 6,000 employees at more than 90 locations throughout the world are working on this challenge. Bruker systems cover a wide range of applications in all areas of R&D and are used in all industrial production processes to ensure the quality and reliability of processes.

E³.series is Zuken's software solution for electrical wiring, control systems and fluid engineering.

E3.series®

E³.series from Zuken is a Windows-based, scalable, easy-to-learn system for the design of wiring and control systems, hydraulics and pneumatics. The out-of-the-box solution includes schematic (for circuit and fluid diagrams), cable (for advanced electrical and fluid design), panel (for cabinet and panel layout), and formboard (for 1:1 wiring harness manufacturing drawings). Integrated with MCAD, E³.series is a complete design engineering solution from concept through physical realization and manufacturing output.

Before the move to E³.series, the electrical designers at Bruker used relatively simple means to produce the wiring documents required. For example, they used a drawing system from PCB design or accessed the MCAD program to draw cables.

But this wasn't feasible in the long term and therefore they started to look for a new solution. "*We wanted to improve the quality of our wiring drawings and documentation, so we carried out a selection process,*" explains Matthias Binkele, who was tasked with rolling out and administering E³.series at Bruker.

Various established systems were put through their paces. Zuken's E³.series, a system developed in Ulm, Germany, came out on top. "*The scope of function provided by this system allows us to best map our X-ray analysis systems*," says Binkele.

More reasons for selecting E³.series included:

- An analysis device may be mapped in various abstraction layers, i.e. one block diagram level with illustrations and real images, one wiring level, and one level with detailed manufacturing drawings. Links ensure rapid navigation between the various hierarchical levels.

- E³.series allows the technician to depict a device in many different ways. It also ensures well-structured device documentation that complies with standards and is consistent with internal standards.

- Multi-user and multi-language capability were considered essential features in E³.series.

Bruker uses the E³.cable (Professional) and E³.panel (Basic) modules.

Jürgen Fink (left) and Matthias Binkele.

Flexible processes – for use at all levels

"*E³.series maps all the device wiring of an X-ray analysis system,*" says Fink, describing how ECAD systems are mostly used at Bruker. This means it considers all electronic control and wiring assemblies, as well as all sensors and actuators. The product development, device assembly, testing, and customer service departments make intensive use of the device documentation produced with E³.series during the entire product lifecycle.

Now we consider the process itself: "*One of the good things about E³.series is that it doesn't dictate where you have to start. Within a project, users can start with the main assembly they consider most effective,*" says Binkele. "*During the development process, distinctions are made between:*

- *logical level (block diagrams)*
- *wiring level*
- *detailed drawing level.*"

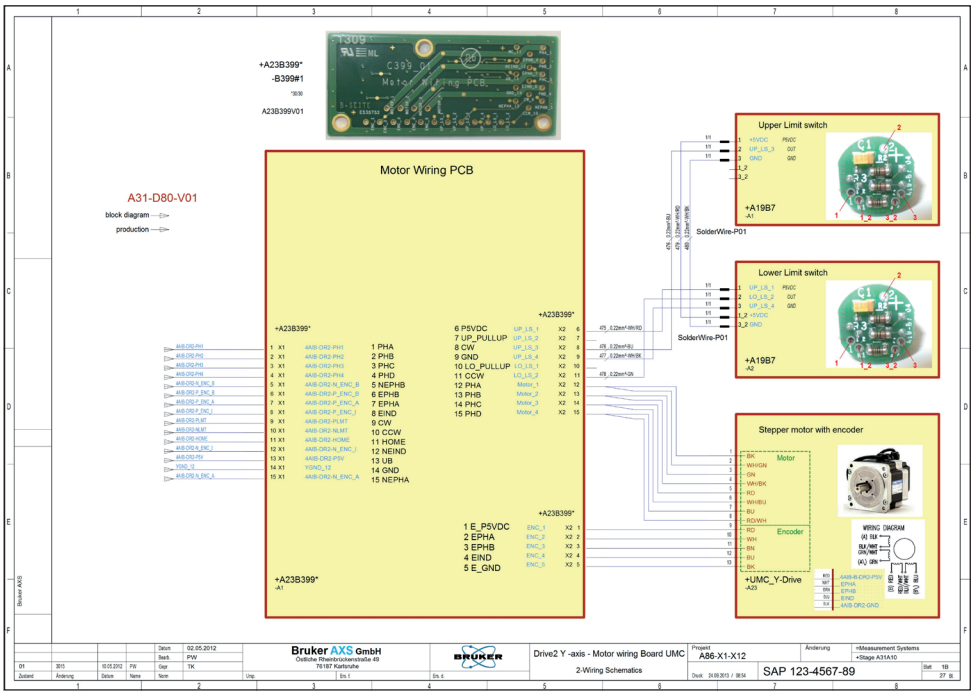
"*All three levels are fully interlinked*", says Fink, "*We work both top-down and bottom-up. The project and the amount of time we have available determine how we proceed.*"

Sometimes the users start with a device component for which a prototype is urgently required. This component becomes a priority and is integrated in the overall plan later on. "*At other times a technician may start at the very bottom with a cable drawing and the cable manufacturer quickly turns this into a sample which is tested in the real world right away*," continues Fink.

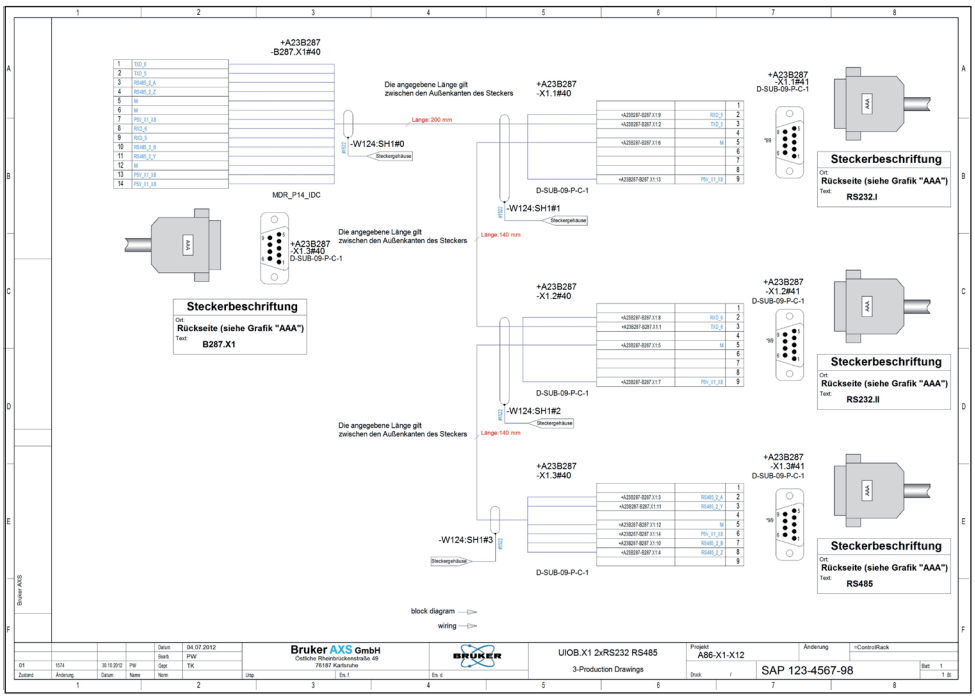
When the Karlsruhe-based company starts work on a new large project, it usually puts together a team of several development engineers and electrical technicians. The development engineers specify the top and medium wiring level and the technicians work with these to produce the detailed drawings, culminating in the cable production drawings. This is easily done since the ECAD system allows for multiple users.

Bruker produces detailed drawings for both individual connection cables and harnesses. These are then turned into cables by external manufacturers who produce all the resources required, such as a formboard.

The completed harnesses are installed in the devices by Bruker so they can be verified. They are then optimized in the virtual world and then again in the real world. "*They should be ready for volume production by the end of the first iteration at the very latest,*" adds Fink.



Example of a schematic concept at high abstraction level, developed with E³.series. Note the photorealistic insertion of electronic parts, which greatly improves understanding.



Cable drawing showing plugs

Outcomes

Once the optimum device documentation structure for Bruker AXS had been developed in a pilot project and the integrated ECAD system database had been adapted and added to, all the X-ray analysis systems can now be fully depicted in E³.series.

"*We are now experiencing a noticeable increase in productivity because we have slashed the time it takes to develop the first sample or pre-series device. Manufacturing drawings for individual connection cables can be produced from the wiring drawings in a highly automated fashion,*" says Fink.

Compared with how employees used to work, the quality of wiring and manufacturing drawings has also vastly improved. This results in higher quality device cabling and means that fewer iteration stages are needed in the development phase.

In addition to the benefits outlined above, E³.series has proven to be highly effective in analyzing device defects. The system allows individual signals to be easily tracked from the sensor/actuator through the wiring assemblies to the control electronics.

Bruker is also full of praise for Zuken. "*Whenever we needed anything, they were always quick to help out. We are delighted with the support provided by Zuken,*" stresses Binkele. "*The same applies to the ongoing development of the system. Capabilities that were only a dream five years ago have now become reality.*"