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## Industry 4.0: The race is on

### The impact on electrical and automation engineering

**The concept of "Industry 4.0" is setting completely new standards for production** and will cause a major upheaval from the point of view of both products and manufacturing. The German associations BITKOM, VDMA and ZVEI have specifically established an office which deals solely with this topic. What then were 1.0 to 3.0? The invention of the power loom was seen as the first industrial revolution while, according to this reckoning, the electrification of production was 2.0 and the introduction of PLC and bus technology was 3.0. We now come to 4.0. Electrical and automation technology will greatly increase in importance, as will the corresponding engineering.

Instead of rigid production lines for large volumes of a product, individual orders will then be processed with the high efficiency and low costs of mass production. Thus, for example, a production line would no longer

be set up, as in the past, for the construction of a specific car model. Instead, production will be so flexible that a line will produce saloons, convertibles and SUVs in alternating sequence, but as fast as ever. A bottling plant will be able to take different recipes and decant them to various containers, configured to suit the customer. This eliminates complex building conversions or modifications whenever a product variation arises.

What role does engineering play in electrical and automation technology? This question can be approached from two perspectives: on the one hand, increasing customisation will have significant influence on the engineering of the product itself, whilst having considerable impact on the manufacturing plants on the other hand. To take the product view:

#### Customisation wins

Here we are concerned with the customised planning of the product itself, insofar as it has an electrical engineering content. The automotive industry has already progressed very far in this respect. The major German manufacturers rely on customised wiring harnesses and modularity. This is the major advantage of German premium manufacturers because their customers expect absolute freedom in the assembly of their desired vehicle. This diversity cannot be compared with the predefined trim levels which, for example, US manufacturers provide. There, they manage to produce about 150 variants, while the advocates of customised wiring harnesses give rise to some 100,000 variants!

To achieve this level of choice, engineering has to offer maximum flexibility and the best possible overview. All possible combi-

nations of the wiring harness must be conceived in advance using a draft of the entire design space in the planning tool, after which they can be reduced to the final design - as with Engineering Base (EB). Here, the graphics are connected to an intelligent, flexible database. This guarantees a continuously up-to-date connection logic. EB's experience with the huge range of variation in the automotive industry can be easily transferred to the flexibility requirements of other industries in terms of Industry 4.0.

#### The manufacturing view:

The second field that is facing striking changes is mechanical and plant engineering. Lines with increasing robotics content and highly flexible manufacturing cells will become prevalent to enable manufacture of "lot size 1" at the same rate as mass production.

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### Values and change

#### Dear readers,

The German journalist Richard Löwenthal once said: "Values can only be preserved by change." The recent changes have created even more values at AUCOTEC, as confirmed by 50% growth in three years. From the appearance of this issue, you will see that we are also progressing in rejuvenating our public image.

AUCOTEC's focus on products and markets as well as its optimisation of customer support and the necessary corporate structure are among the complex content-related changes. Here, Engineering Base is the most successful driving force of our strong and increasing

market position in the fields of mechanical and plant engineering, energy, automotive and process engineering. The system is so flexible that it can now support your initial steps along the path to implementing the idea of "Industry 4.0".

The development and expansion of our international presence has also proven successful. The partnership with Emerson PWS, a group of companies based in the US, which is described on page 2, is one of these success stories.

Currently, we have expanded our resources for analysing and optimising your engineering processes and also offer you commer-

cially attractive packages for the SPS IPC Drives trade fair (page 2).

Our goal is to preserve and increase your corporate values. With this goal in mind, we will remain flexible in the future and will face the changes in your industry and your company in an open and constructive manner.

You are assured of this by

**Markus Bochynek**  
Executive Officer



We are looking forward to meeting you!

**sps ipc drives**



Nuremberg, November 26 – 28th, 2013  
Hall 11 / Stand 320

#### Further topics:

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New plant construction package optimises complete engineering process

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Functional engineering as management support

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Success stories: Böwe and ThyssenKrupp Marine Systems

# Industry 4.0: The race is on

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Recognising geometries and the information contained in the blank and responding to them within fractions of a second requires any number of sensors and actuators to be planned and documented. Their intelligence will also increase. More complex data streams and more time-consuming control tasks demand a planning system that is adequate for the job.

The engineering complexity increases at the same rate as the automation technology proliferates. Engineering has to counter this development with time-saving flexibility, consistency and quality.

## The process industry shows the way

The handling of mass data is part of everyday life in process engineering and EI&C planning. EB is in use in those areas in major plants from sugar refineries to cement factories. Mechanical and plant engineering can benefit from its use, for example, with the tabular editing of tag data that is prevalent in process engineering. The trend is already progressing in this direction with the design process, but it can only be implemented using a central database. This is the only means by which time-consuming steps in graphic operations can be omitted or automated. EB automatically updates all further displays when an object is edited in a report, worksheet or drawing.

The database-supported management of measurement and actuator tags and the automated assignment of inputs and outputs from PLCs and control systems are among EB's other capabilities gathered from process engineering that can assist in making the future flood of data in Industry 4.0 more manageable.

## Machine modularity is on the increase

When considering the individual machines in a plant, the manufacturing view quickly becomes the product view and completes the circle: **A machine** that can process 10 differ-

ent products in sequence must be nearly as complex as a car. Thus the topic of modularity will receive a powerful impetus in the field of special-purpose machinery. Highly complex modular systems will become even more essential. Conventional engineering without a central database ("single source of truth") will not be able to cope with the pending flood of data and combinatorics. EB, which already has the vast amounts of data of the pioneering industries under control, not only paves the way to the goal, but makes it possible in the first place!

## "Prepared for Industry 4.0"

Andreas Kurth is Engineering Director for Electrical Technology at Oystar's Hassia site in Ranstadt, which has been working with EB for some time. The Oystar group is one of the world's leading firms in the field of packaging. As a variety of machine lines converge at Hassia sites, the highest demands were made on consistency and uniformity in their engineering. EB also combined the electrical and process engineering. "This combination of expertise is unique,"

says Kurth, "and the various departments are today working together almost automatically on a database that speeds up matters significantly. As a result of EB's database concept, we have also made significant strides in minimising the error rate in the creation of drawings and parts lists in highly varied fields such as electrics, pneumatics and process engineering."

Precise

## Certainly more efficient

Analysis, implementation and training: **new plant construction package optimises complete engineering process**



Integrated engineering process in the plant construction package

**On the occasion of SPS IPC Drives 2013, AUCOTEC has put together a new combined consulting and software package** specifically for the challenges facing plant engineers. With its comprehensive process analysis, ROI assessment, project plan with milestone definitions, as well as clear implementation recommendations, it provides management with a unique oversight and certainty in planning. The first analysis clearly sketches the amount of time and effort needed and the expected returns for customising electrical engineering processes. The second component of the package then delivers a distinct increase in efficiency by converting the analysis results into a consistent process, optimised across all the disciplines involved, using the database-driven Engineering Base (EB) platform.

The comprehensive package is rounded off by functions that accompany the whole organisation of the project, including its implementation, and creation of a client-

specific process manual plus user training based on the manual for all the disciplines involved.

## No niche solutions

Over 30 years of experience have taught AUCOTEC that genuine progress and worthwhile gains in efficiency cannot be achieved by optimisation in individual engineering niches, however effective that optimisation may be. The optimisation potential is now far greater due to the highly integrated engineering process, collaborative work and central data management with EB.

The system starts with the plant overview and, in addition to the usual identification of cables, control details or cabinets, combines the automation design and pneumatics/hydraulics as well as the production-related topics and revisions. This avoids multiple entries, consultations, sources of error, in short, EB gains a lot of time, for IT services too - for certain!

## The Energy and Water Supply branch of Emerson signs global cooperation agreement with AUCOTEC

**Emerson Process Management Power & Water Solutions, Inc. and AUCOTEC have signed a five-year contract** for global cooperation, which regulates the integration of the AUCOTEC software Engineering Base (EB) into the Ovation™ control system portfolio of Emerson. As a result of this agreement, Emerson will provide the EB-based Ovation Documentation Builder (ODB) to the users of its Ovation control system in the field of energy generation and the water and wastewater industry all over the world. The ODB can be used for planning, construction and operation of units which are controlled by the Ovation system from Emerson. The agreement also deals with the further development and integration of AUCOTEC software in the Ovation Documentation Builder.

The Ovation system is a world leader, both in the field of controlling crucial power generation processes in conventional power plants using fossil fuels, and in the generation of renewable energy from biomass, solar, and hydroelectric power. Ovation control systems are widely used in water

and wastewater treatment and in the distribution companies of North America in some of the largest metropolitan areas of the continent.

The agreement reinforces Emerson's abilities as a major automation company because it enables Emerson to offer the complete project and engineering documentation and the entire operation automation engineering from a single source. As intelligent drawing software that is closely connected to the Ovation Control System database and the engineering tools, ODB saves hundreds of engineering hours by generating the project documentation automatically. Its synchronisation functions ensure that the documentation is updated automatically if technical changes are made in the project.

After having successfully introduced the Ovation Documentation Builder in key projects in Europe, Emerson is now offering this expertise worldwide as more and more power plant operators require their suppliers to assume comprehensive engineering tasks. This also includes the requisite

documentation for operating the power plant, but which is not necessarily associated with the control system, for example, loop and cabinet diagrams or P&IDs.



Thermal power plant in South Korea

# Not just a matter of opinion

## Functional engineering as management support organises, secures and saves time

**What do we mean by functional? Even Wikipedia knows that often only a renamed components view is behind** discussions of functional orientation ([http://en.wikipedia.org/wiki/Requirements\\_management](http://en.wikipedia.org/wiki/Requirements_management)). A PLC or pump has a function of course, but it is unsuitable as an organising factor. When properly understood, function-oriented (or requirements) engineering supports requirements management, for example, by functions such as “Gripping” or “Heating” grouping components as general terms. These functions are tangible and their distribution can be easily traced via the management and from all users to the customer.

### Expensive misunderstandings

By function-oriented engineering, for example, we mean that the “Gripping” function refers to all devices used during gripping. This type of grouping allows clients and contractors to speak the same language from the outset and thus have a common understanding of the subject of the order. This saves a lot of time.

In contrast, expensive misunderstandings repeatedly occur with the components-oriented view solely because “left” and “right”, “front” or “rear” are relative terms when users and developers are facing a machine in the truest sense of

the word. With pneumatics and electrical systems, certain components can be presented from different perspectives in the various diagrams and lead to confusion accordingly, which is often only noticed during construction. The management has no control in the ongoing process and no way to detect and prevent such errors in time.

### Complete control

Only the function-oriented “link” between several components and a common data base (“single source of truth”) ensure that everyone involved edits the same component with the same goal, even if it is placed in front from one person’s perspective and at the rear for another person.

The shifting back and forth of responsibility, delays, additional costs and material wastage can thus be reduced significantly. Furthermore, management always has an overview. There is only one source of information because the different disciplines build on exactly that data which the colleagues of the upstream department have already compiled. This work method also facilitates parallel development, which AUCOTEC provides with Engineering Base (EB) in the most convenient manner.

The workflow starts with the customer requirements, which tend to be more functional, thus tangible. The transporting, gripping or heating of certain quantities or substances is

required. These requirements are transferred initially to a requirements list. Prices can also be clearly assigned and offered or changed quickly and reliably. Once the functions have been documented, you can simply use these modules again in subsequent projects. If a customer subsequently changes his mind and wants, for example, a faster drive or a smaller gripper, the functional view will ensure that you do not forget any part associated with the adjustments. With the components orientation, you can hardly tell which component belongs to which requirement.

### The more complex, the more necessary

For complex products, which Industry 4.0 will increasingly create, it is essential to retain customer requirements in a manner which can be checked and traced. With its function-oriented view in the object model, EB permits project management with exceptional consistency. No other system offers such good conditions for the future challenges in mechanical and plant engineering as EB!

## “You will notice the difference!”

Interview with Ulf Klein, 48, independent consultant for engineering processes



Under the name of the company he founded in 2013, case4k, the qualified electrical engineer develops design processes for and with his clients. Klein also assists in the subsequent implementation of these processes. The experienced electrical designer, who also worked for eight years as a senior consultant for Eplan Software & Service GmbH, focuses primarily on the consistency of data and processes from manufacturing to sales. The communication between departments, clear naming conventions, structuring of products and templates as well as configuration and reuse are issues which are important to

him. Ulf Klein and AUCOTEC met for the first time during a major project of a renowned machinery and plant construction company.

**As an independent consultant for the functional mechatronic engineering process, you get around a lot. Which area do you think is in urgent need of improvement?**

On the one hand, the lack of communication and data consistency between departments. The common “language” is also missing here. Everyone has their own point of view and work method in the design process, and these views are usually incompatible with each other. On the other hand, consistent data management across the design systems is a key criterion for improvement. There is also a need to minimise competitive departmental thinking, which hinders common project thinking.

**Which adjustments do you think are the most important when redesigning engineering processes?**

I know from experience how important it is to raise awareness of the requirements, views, and work methods of colleagues from other departments. The functional structure provides the optimal basis for defining a common design “language” that would overcome this hurdle. Of course, a business decision and business support are also required for such change processes.

**In your opinion, how much can a company benefit from functional engineering?**

There is a huge increase in quality as the departments no longer come to contrary results. Everything fits together better and is complete, including all changes. The high quality saves time in manufacturing and commissioning. The optimised communication and the consistency of data from manufacturing to sales speed up design processing times. The function-oriented approach promotes cooperation because those involved assume joint responsibility for the result. When organising the solution is the goal, the manufacturers gain a lot of synergy and time, and their customers also benefit from this!

**In your opinion, what are the major obstacles to implementing functional engineering? Why is it still so uncommon?**

Standardisation and some design systems are ahead of their time and provide a good basis for using the functional structure. People are the hurdle. For a start, they shy away from change. “Don’t touch a running system” is stuck in their minds. Since the expected improvements can usually only be estimated, they are deferred until they are inevitable. This is because most people simply don’t know that machines and plants are easier to understand using functional structures and how much this common view simplifies communication. The corporate culture must support colleagues talking to each other, engaging with each other,

and understanding each other. Competition between departments often tends to be encouraged, based on past practices. Define a team from sales and the different design groups with a mechatronic team leader who is oriented to the overall result, and you will notice the difference!

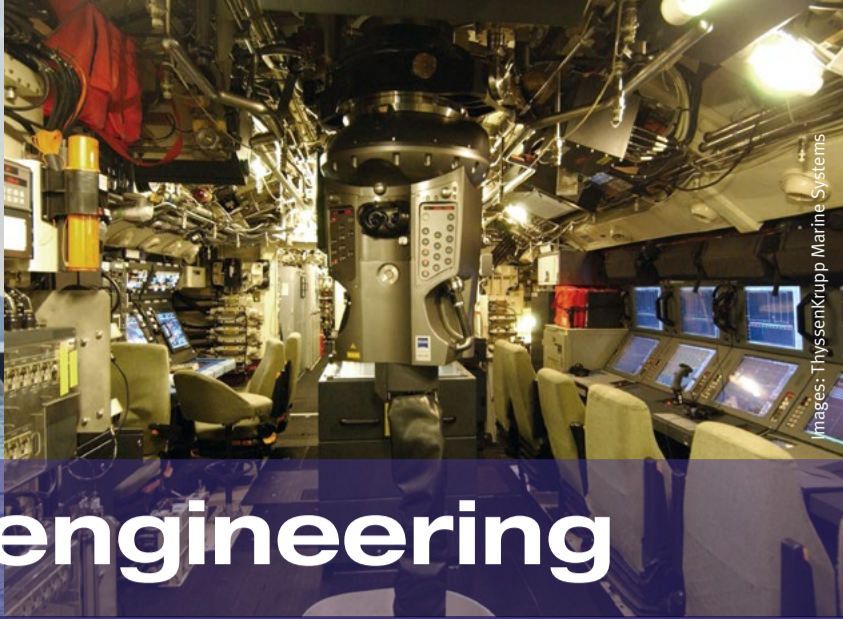
**You also advise when selecting the appropriate software tools for process optimisation. What must the ideal engineering system be able to do at all costs?**

The system should enable the structuring of the views defined in EN 81346 such as functional structure, location structure and product view. It would be ideal, if not actually essential, to have the option of assigning parameter values, parts of documents and objects to the objects of the functional structure. These documents and objects can then be reused much easier.

**You have had experience with Engineering Base at a major plant construction company. What distinguishes EB especially from your point of view?**

Firstly, everything that I have just listed. EB meets these criteria. The system maps the functional structure of the plant completely and can also define the necessary infrastructures for the functions. Engineering Base is wholly object-oriented. All objects can be fully pronounced because they can adapt to the requirements, and the necessary properties can be added to them. There are only a few tools, including EB, which map functional structures well and flexibly and enable users to be able to use them as the basis of their design.

**Mr. Klein, thank you for the interview!**



# Launching more **efficient engineering**

## Submarine shipyard ThyssenKrupp Marine Systems relies on standardisation with EB

**The core business of the HDW line of business at ThyssenKrupp Marine Systems is designing and constructing** the most advanced non-nuclear submarines for the German Navy, as well as for partners worldwide. Since 2005, the 175-year-old company from Kiel in northern Germany has belonged to the ThyssenKrupp Group. In addition to turnkey high-tech submarines, its portfolio includes submarine-specific systems and devices, the reconditioning and modernisation of submarines, as well as a comprehensive service concept including training.

### Connecting processes efficiently

The rapidly growing complexity of submarines necessitated the reorganisation of the electrical design including the change from many individual files to an integrated database system. The stated objective of the Design and IT teams is that all disciplines

involved can access the same database to connect the engineering processes efficiently.

Engineering Base (EB) met these criteria best and immediately achieved more reliable quality in its product model and consistency of information. This is particularly important because the diversity of components and project periods of up to 7 years result in enormous amounts of data. There are also numerous changes that require the highest consistency. "EB does this very efficiently because regardless of the graphical representation in which an object is edited, every other representation adopts it immediately", explains Thomas Fraller, engineering expert at ThyssenKrupp Marine Systems.

### "Tapping into new markets"

In addition, changes can be very easily passed on, for example, to identical sister ships or an entire class of boat. ThyssenKrupp Marine Systems relies on the fact that even more employees and suppliers are able to participate in the database in the medium term due to EB's integrity of information. This saves a lot of manual work and coordination processes. Thus the company intends to integrate EB deeper into the product definition process. EB has a wide range of solutions due to AUCOTEC's many years of experience in process engineering and wiring harness design development. ThyssenKrupp Marine Systems sees the platform as the strategic electrical design system for submarine development. "We would thus like to tap into new markets and extend standardisation significantly", says Thomas Fraller.

### Key User team

Employees of all relevant departments were trained as application support staff when EB was introduced. "The transition was difficult initially", admits Thomas Fraller, who manages this Key User team. "We previously worked in a very drawing-oriented manner." Today, he is free to choose where he creates data. In addition, EB shows all dependencies. "This allows different approaches on the one hand, while the vastly improved consistency saves a lot of time on the other hand", says the engineering expert. From the smallest device to complex systems, all associated information of the entire chain can now be easily controlled and edited in a traceable manner.

# The mail is really taking off with **Engineering Base**

## Standardised engineering and the deepest SAP integration make **BÖWE SYSTEC** much faster and their documents far better



Large crowds at the launch of BÖWE's new inserting system "Fusion Cross" at the Print trade fair (United States)

**BÖWE SYSTEC GmbH is one of the leading global solution providers for modern printing and mail processing centres.** In its over 60-year history, the company developed from being a manufacturer of cutting machines for endless documents to become a globally active full solution provider for the mailroom - including special software concepts. BÖWE

SYSTEC and its international subsidiaries belong to the Possehl Group, which generates annual revenue of about 2.5 billion euros with its over 10,000 employees.

### "Ready-made solutions from the standard repertoire"

In 2010, BÖWE SYSTEC started to establish within a very short time a revolutionary new high-performance inserting system, where the envelopes are filled while the transport is moving. At the same time, BÖWE SYSTEC decided on a new drive and IO system, which resulted in changes in the electrical documentation. In addition, it was necessary to improve the support for compliance with standards. And: "We wanted to get away from the insular world of various systems that operate in isolation", says Bernd Höpner, Head of Development.

Thus Engineering Base (EB) was chosen. "We were won over by the fact that AUCOTEC was able to show clear proposals for solutions to our requirements directly from the standard repertoire in a live system, without extra programming", says Höpner. "Our vision became reality remarkably fast", he concludes about EB, with which BÖWE SYSTEC

has managed the highly complex "Fusion Cross" electrical documentation with completely new components in a very short time.

### SAP or EB?

A special highlight of the solution is the interfacing of electrical engineering with SAP. "It has a unique depth", says the head. Switching systems and changing to another software as well as any logons are things of the past. The user no longer sees that he is leaving "his" system. The creation of bills of material and checking of documents directly from EB are largely automated. The diagrams are stored with their change history in SAP and can be viewed and approved. "This not only saves time, but also increases the quality of our stored documents", says Bernd Höpner.

### The next step

In future, the individual, fully documented standard components must be able to be compiled automatically from a list for the machine desired by the customer, in the form of an overall plant design in a single-line diagram. "This will greatly accelerate our order processing", explains Bernd Höpner. EB makes it possible!

And furthermore ... the following companies, among others, have recently opted for AUCOTEC:



Rippert Anlagentechnik GmbH & Co KG,  
Herzebrock-Clarholz, Germany



Shanghai Schneider Electric,  
Shanghai, China



Energieversorgung Offenbach,  
Offenbach, Germany



Toshiba T&D Europe SPA,  
Genoa, Italy



Scandinova Systems AB,  
Uppsala, Sweden



Automalógica - sistemas para automação,  
Jundiá, Brazil

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Legal Notice:  
AUCOTEC INFOpaper

Publisher:  
AUCOTEC AG  
Oldenburger Allee 24 | 30659 Hannover

Responsible for the content according to the law:  
Johanna Kiesel | Press and Public Relations

Design and Typesetting:  
www.linienflug-design.de

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