

Process innovations in control cabinet manufacturing

Customised comprehensive solutions from a single source

The control cabinet manufacturing sector faces many challenges, which are growing at an ever-faster pace against the backdrop of Industry 4.0. An innovative solution based on the principles of lean management, digitalisation, and automation supports control cabinet manufacturers in a number of ways (Figure 1 lead image).



Figure 1, Lead Image - The future of control cabinet manufacturing: products with digital descriptions and the optimum provision of information increase efficiency and shorten production times

Challenges faced in control cabinet manufacturing

Control cabinet manufacturing companies are confronted with constantly growing challenges. For example, increasingly short delivery times are expected without compromising on the high degree of flexibility. There also needs to be scope to allow for changes later on as the project progresses. High quality as well as comprehensive and precise documentation also place high demands on processes and systems.

In addition, there is growing pressure on costs due to manual activities increasingly being relocated to regions with lower labour costs. Batches at the smallest end of the spectrum offer little in the way of scaling effects for cost reduction. In control cabinet manufacturing,

small and medium-sized companies in particular often do not have enough experience or sufficient options here.

The systematic use of lean management methods is one promising approach. Together with aspects of digitalisation and automation, the entire process chain in control cabinet manufacturing is analysed and developed further.

The availability of all digital product data is absolutely crucial to the success of digitalisation and automation. This is why Phoenix Contact consistently relies on the eCI@ss standard. The aim is to examine the process chain together with the control cabinet manufacturing customer: from planning and engineering processes to the production of individual control cabinet modules or the entire control cabinet. Suitable lasting and effective measures are devised for each sub-process (Figure 2).



Figure 2 - Entire value added chain: from planning and engineering through to in-house or external production – there is significant potential for increasing efficiency

Planning and engineering

The core task in the planning and design phase is to create the appropriate electrical circuit diagrams for a given electro-technical task and to define a suitable combination of products. The project complete planning and marking software from Phoenix Contact provides support throughout the entire process in order to arrive at the appropriate terminal strips based on the electrical functionality defined in the CAE (computer aided engineering) program. The data can be read in from all common CAE programs via a wide range of interfaces and automatically converted into a terminal strip configuration. Necessary accessory materials are then automatically added based on the product knowledge stored in the software, thereby ensuring safe operation.

Following successful configuration, information regarding the price and availability can be obtained in real time via an online interface, and the order for the entire terminal strip project can be submitted. Innovative functions, such as intelligent wizards for terminal marking or setting bridges, simplify many of the planning steps and save a significant amount of time.

Not only can the resulting terminal strip configuration be used to place an order directly, it can also be used to enrich the project data in the CAE program via bidirectional interfaces. Furthermore, project complete provides all the necessary information to produce the terminal

strip: either as a digital production document for manual assembly of the DIN rail or as an export in AutomationML format for controlling fully automated systems in terminal strip production.

Scalable in-house production

Depending on the business model, a control cabinet manufacturer's core competencies may include different sub-processes which are the focus of their in-house production. For example, their core competencies could be engineering, final assembly, and start-up – but not the actual production of control cabinet modules, so this process step is outsourced. Likewise, a manufacturer could just offer production as a service, but not engineering.

There is huge potential to increase efficiency among control cabinet manufacturers who produce terminal strips in-house. Order picking and quality assurance have a significant impact on the lead time and production costs, especially when dealing with small batch sizes and high variance. The efficiency of the process chain can be increased significantly by production systems with a scalable level of digitalisation and automation – from cutting DIN rails to length and snapping on alignable components through to custom marking.

The key basic criteria for the further development and optimisation of traditional manual assembly processes are digital production documents – for example, through the use of project complete at the assembly workstation – as well as an ergonomic workplace design and efficient provision of materials. Next, assembly assistance in the form of data-based, real-time support for assembly processes helps reduce search times and mistakes. The main challenge is converting the digital description of the module being assembled into a sequence of production instructions that can be depicted via an assistance system. Various options are available when it comes to the technical implementation of the assistance system: from simple screen displays and pick-by-light solutions through to augmented reality applications.

The main process steps in terminal strip production offer significant potential for automation thanks to production sequences that can be easily standardised. Based on the modular automation of individual processes, production lines can be designed in accordance with customer-specific requirements regarding the level of automation and product variance. In particular, automation of the marking process can increase efficiency significantly. The direct laser marking technology developed by Phoenix Contact for fully assembled terminal strips means that it is no longer necessary to create and attach the marking manually. Thanks to

the flexible handling system and non-contact marking, the marking process is also very quick for components on the DIN rail that have a high degree of variance. The effort involved here can be reduced by up to 50 percent. This automation step is based on the ClipX.Marker marking module as well as products with surfaces that can be marked (Figure 3).



Figure 3 - Making its mark: laser marking of fully assembled terminal strips significantly reduces the amount of effort required for marking

Flexible production services

If terminal strip production is not one of the control cabinet manufacturer's core competencies, or if order peaks need to be flexibly managed, external production services can bridge the gap. This is why Phoenix Contact offers a production service for custom-configured terminal strips. The project complete software ensures the seamless flow of data from terminal strip planning through the ordering process to the production process. In this way, the configured terminal strips with complete digital descriptions are produced and supplied in a short space of time. As part of the further development of production based on lean principles, traditional workshop production is replaced by modern continuous production here. As there are no longer any intermediate buffers with idle and waiting times, lead times can be reduced by up to 40 percent (Figure 4).



Figure 4 - Terminal strip production in full flow: a production system design based on the flow principle minimises lead times

Summary

Phoenix Contact offers a comprehensive consulting and solution portfolio for the entire process chain in control cabinet manufacturing - from planning right through to production. Scalable solutions mean that all the individual conditions of control cabinet manufacturers can be taken into consideration.

More information

phoenixcontact.com/completeline

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COMPLETE line at a glance

COMPLETE line

COMPLETE line is a system comprising technologically leading and coordinated hardware and software products, consulting services, and system solutions for the optimisation of all processes in control cabinet manufacturing. This simplifies engineering, purchasing, installation, and operation significantly:

- Intuitive handling, thanks to the uniform design, haptics, and function
- Saving time in the entire engineering process, thanks to seamless software support
- Reduced logistics costs with standardised accessories and reduced parts diversity
- Optimised processes in control cabinet manufacturing, thanks to individual services and innovative manufacturing solutions