



Liebherr-Verzahntechnik GmbH and TDM Systems

Automation booster: Perfectly integrated software solution digitalizes the process chain

Liebherr-Verzahntechnik GmbH has already been operating unmanned production at its site in Kempten, Germany for years. This is quite an achievement, since none of the machines it produces are "off the rack" standard series units. The company's ability to manufacture its high-grade products efficiently and on schedule, despite their high degree of individualization, is due to the close integration of the software solutions used – and its willingness to say goodbye to standalone solutions.

The Kempten-based company has been one of the leading manufacturers of gear cutting machines and automation systems for seven decades. Yet the increasing individualization of the machines, the ever smaller lot sizes, as well as the desire to secure the shortest possible lead times, were presenting Liebherr with major challenges. Working toward the goal of process reliability, the Kempten-based company therefore implemented a consistent digitalization and automation strategy, and is now facing the competition with quality and flexibility.

Automation from a lot size of 1

The company has been providing turnkey manufacturing cells and production lines since as early as the 1970s. Its own shopfloor is also highly automated and thereby clearly demonstrates that "flexibility and automation go hand in hand at Liebherr," as Matthias Dodel, CAM Programmer and Production Line System Supervisor at Liebherr, is keen to stress. Since small series all the way

down to a lot size of 1 with a high degree of parts variation are produced at the Kempten facility, various automation approaches are employed, including a Liebherr pallet handling system. The workpiece to be machined is clamped onto a uniform carrier plate outside of the machine by an operator and then temporarily stored in the integrated high-bay stacking storage system until it is time for machining. When the control computer issues the order for machining, the carrier plate with the workpiece is transferred to the machining center by the storage and retrieval vehicle and then picked up again afterward. All travel and entry/removal movements are performed automatically without any human input.

The SOFLEX PCS production control software ensures long tool lives here, despite the high degree of individualization of the workpieces. It controls the entire manufacturing process and plans the complete workflow on the basis of the data in the ERP system. Through interaction with TDM Tool Management, "this facilitates highly flexible, reliable, and efficient manufacturing around the clock," as Dodel underlines.

TDM in use

Replacing outdated software solutions

Following the decision to go with an automated milling and turning center, the other involved systems were also closely examined and the entire process chain was reconsidered. Perhaps the biggest issue here was the tool management system that had previously been used, as this was no longer capable of meeting the new challenge: "It was a proprietary standalone solution, which had been specifically tailored to work with our previous CAM software and was therefore not compatible with the new solution."

However, modifying the existing solution to work with the new system would have been extremely time consuming and costly. Even then, it would have been almost impossible to implement an end-to-end process chain for the entire shopfloor. "Since we did not have the requisite interfaces, continuing to use the software would have been a constant challenge for us," comments Dodel.

Right from the outset, Liebherr was therefore looking for a solution partner that "does not suffer from any technical limitations in terms of the interfaces to all possible shopfloor applications". Since the company repeatedly encountered highly satisfied TDM users during its reference visits to numerous CAM manufacturers and, according to Dodel, also within the Liebherr Group, Liebherr took the decision in 2018 to go with the tool management solution offered by TDM Systems.



CAM programming with direct access to tool data and graphics.

Open systems secure data transfer

"TDM is a software with many interfaces that offers us great versatility and freedom, enabling us to implement our digitalization concept efficiently," comments Dodel, summarizing the management decision. By taking this decision, Liebherr is also securing its long-term investments – as the neutrality and transparency of the TDM system mean that the company is not tying itself to any specific software supplier on the shopfloor.

The implementation of the software went without a hitch, and the data transfer also went as desired right from the outset. One thing quickly became clear here: "Eliminating manual data input reduced the error rate down to zero," comments Dodel. Liebherr not only uses TDM in the classic way for tool management, but also as a document management system for the CAM documents, NC programs, or setup instructions. The Tool Crib and Fixture Management Module together cover all tool and fixture requirements of the machining centers. The interfaces to the ESPRIT CAM system, the Soflex manufacturing control system, and the Zoller presetting system enable an automated flow of data. In another interesting perspective, the Service department uses the automated tool crib connection of TDM to manage the equipment used by the technicians.



Inserting the tool assemblies into the loading/unloading station.



TDM is a software with many interfaces that offers us great versatility and freedom, enabling us to implement our digitalization concept efficiently.

Matthias Dodel,

CAM Programmer, Production Line System Supervisor & TDM Project Manager at Liebherr Verzahntechnik GmbH



TDM in use



Without TDM, it would not be possible to maintain an overview of the 3800 tool assemblies or make these available to the machine at the right time and in consistent quality.

Matthias Dodel,

CAM Programmer, Production Line System Supervisor & TDM Project Manager at Liebherr Verzahntechnik GmbH



Direct data access saves time

With small series down to a lot size of 1, NC programming can quickly become a bottleneck on the shopfloor. According to Dodel, any company that is either unable or unwilling to hire additional personnel for this will therefore need to optimize their processes. Liebherr has clearly succeeded in achieving this. In fact, the company has produced approximately 5000 NC programs within just four years – while operating with the same workforce and also extending its fleet of machines. "In the past, this would have taken us ten years," comments Dodel, smiling about the substantial time savings achieved. The tool inventory was also digitalized by this team in parallel, which involved creating the entire tool database and performing further data maintenance.

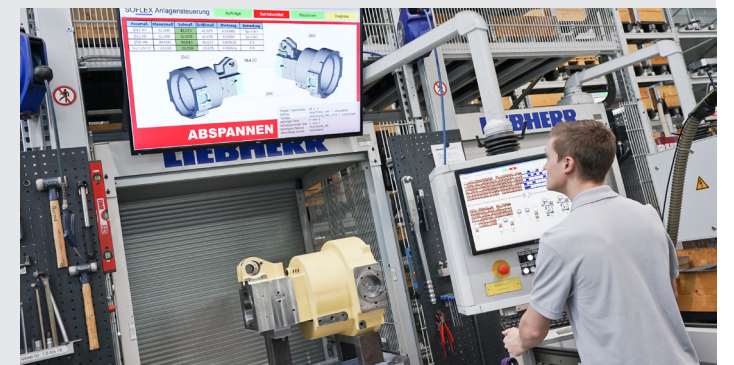
The fact that TDM helps the NC programmers to achieve such excellent efficiency can be attributed to the modules for data and graphic generation, as well as the TDM-ESPRIT CAM interface. After all, this facilitates end-to-end use of the unequivocally defined tool assemblies, also as digital twins for simulation purposes. In addition, manual data input during programming is completely eliminated.

100% available tool assemblies

At Liebherr, tool management revolves around tool assemblies. Indeed, the company manages some 3800 tool assemblies and 7000 fixtures. When the manufacturing control system is planning an order, the tool assemblies required for this are determined. The requirements are then compared against the tools available on the machines and the respective tool lives. If any tools are missing, these are fitted, preset, and measured on the basis of a requirements list from Soflex. Presetting operations also work with data from TDM and automatically access the target data defined. In other words, data is now only transferred and no longer entered manually. Tool changes are performed when necessary or once the respective tool life has expired. This is a fully automatic process without any human intervention. "Without TDM, it would not be possible to maintain an overview of the 3800 tool assemblies or make these available to the machine at the right time and in consistent quality," stresses Dodel. "Without the software, we simply would not be able to ensure the requisite tool supply – which would then also make automation impossible."



The high-bay stacking storage system, in which the components are temporarily stored on carrier plates until they are needed for machining and also automatically removed when required.



Set-up station with cell controller from Soflex.



Unique tool identification via barcode.



Unique tool identification via barcode.

Summary and company

Automation is unimaginable without tool management

"In summary, it is important to state that we now always work with reliable data thanks to the automated data transfer from and to the TDM software," as Dodel stresses. TDM Tool Management plays a key role in ensuring that the systems and processes are all properly networked and work perfectly at Liebherr, that the data can flow, and that procedures can be interlinked on an automated basis. "This not only enables us to fill our customer orders more quickly, it also makes us

significantly more competitive, as we can maintain our quality at a consistently high level," comments Dodel, expressing his pleasure with the system. To become even more efficient in future, Liebherr Verzahntechnik GmbH is aiming to reduce the scope of different processes and tools by standardizing its technological guidelines. According to Dodel, this is one area in which "TDM will also provide us with great support".

Liebherr-Verzahntechnik GmbH: Gear cutting technology and automation systems

Liebherr develops and produces high-grade gear cutting machines, gear cutting tools, gear measuring devices, and automation systems. In 2021, the company generated sales revenue of EUR 210 million in the product segment of gear cutting technology and automation system with a current workforce of 1664 employees at various locations. It also presented product and technology innovations in the field of gear cutting technology and automation in 2021. The topic of mobility represented a particular focus here. Above all, the field of electric mobility offered great potential for gearing technologies. This is because internal gears are increasingly being used and these have strict requirements in terms of the quality of machining.



EVERYTHING AT A GLANCE

Tool management integrates processes and ensures tool availability
TDM in use at Liebherr Verzahntechnik GmbH



Mechanical engineering

- Gear cutting machines
- Gear measuring devices
- Gear cutting tools
- Automation systems



Company

- 1664 employees at various locations
- Founded in 1969
- Headquarters in Kempten in the Allgäu region of Germany



TDM in use at Liebherr Verzahntechnik GmbH

- TDM Base Module
- TDM Data and Graphic Generator
- TDM Tool Crib Module and TDM Fixture Management Module
- TDM Integrated NC-Program Manager
- Interfaces to the Kardex crib system, Zoller presetting system, Soflex manufacturing control system, Esprit NC programming system

BENEFITS



- Minimize sources of error:
- thanks to complete elimination of all manual data input in planning and production



- No more collisions
- due to use of the wrong tools



- 100% tool availability at the machines
- in consistent quality and at the right time



- Absolute process reliability
- throughout the entire process chain facilitates unmanned production, also over weekends

Prior to implementation of TDM

- Replacement of the outdated tool management and CAM system, as not designed for automated production
- Implementation of the Liebherr digital concept and redesign of the entire process chain in planning and production with automated, end-to-end flow of data
- 100% tool availability at the machine for automated setup

Process innovation

- More efficient CAM processes: Access to end-to-end data and graphics, as well as defined standard tools for each machine
- Comprehensive networking with the production systems facilitates reliable tool requirement planning for all orders/machines
- Automated tool provision thanks to available lists of requirements and installation instructions
- Wide range of interfaces facilitates a fully end-to-end process chain and tool data support in all shopfloor systems
- Reproducibility is secured through document management and tool lists



TDM Systems · A Member of the Sandvik Group
www.tdmsystems.com

TDM Systems GmbH
Derendinger Straße 53 · 72072 Tübingen · Germany
Phone +49 (0) 7071 9492 0 · Fax +49 (0) 7071 9492 707

TDM Systems, Inc.
1901 N. Roselle Rd. Suite 800 · Schaumburg · IL 60195 · USA
Phone +1 847-605-1269 · Fax +1 847-605-0586