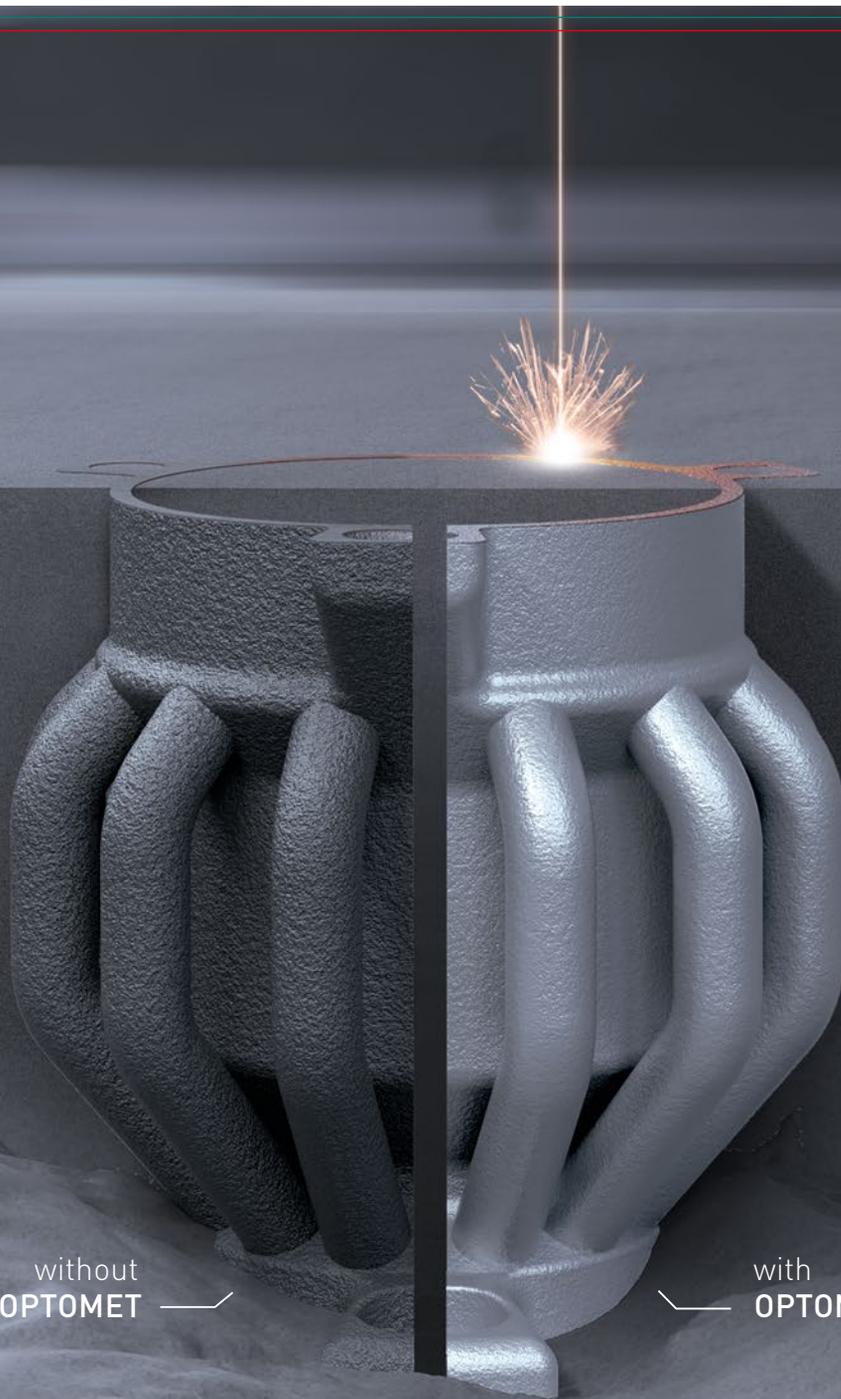


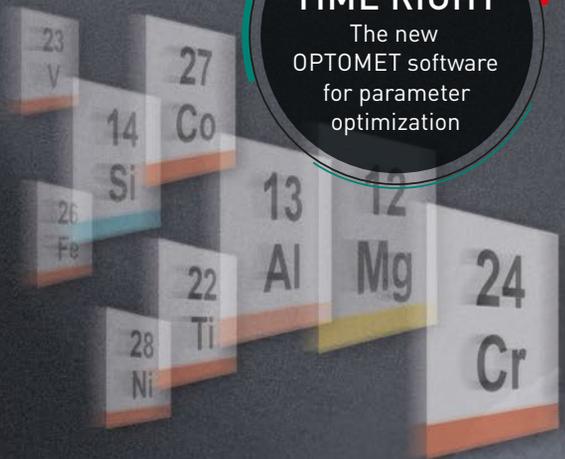
TECHNOLOGY EXCELLENCE



without
OPTOMET

with
OPTOMET

**FIRST
TIME RIGHT**
The new
OPTOMET software
for parameter
optimization



ADDITIVE MANUFACTURING

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made of aluminum

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SHAPING THE FUTURE WITH DYNAMIC AND EXCELLENCE

DMG MORI can look back on an eventful year. In addition to **record high sales**, we achieved a great deal in 2018 and created innovations. Most especially we advanced our future fields with **dynamic and excellence**:

AUTOMATION

- + **Robo2Go 2nd Generation**: Flexible workpiece handling for small and medium-sized batches that can be programmed simply and intuitively
- + **WH and PH series**: Robot-supported workpiece and pallet handling for optimum productivity

DIGITIZATION

- + **CELOS**: Efficient workflows for machine and shop floor organization
- + **ISTOS**: Your entry into “smart” production thanks to new micro-service architecture taking the digital factory at FAMOT as an example
- + **WERKBLIQ**: Internet-supported maintenance optimization for medium-sized enterprises
- + **ADAMOS**: Manufacturer-independent IIoT platform for continuous added value for the customer

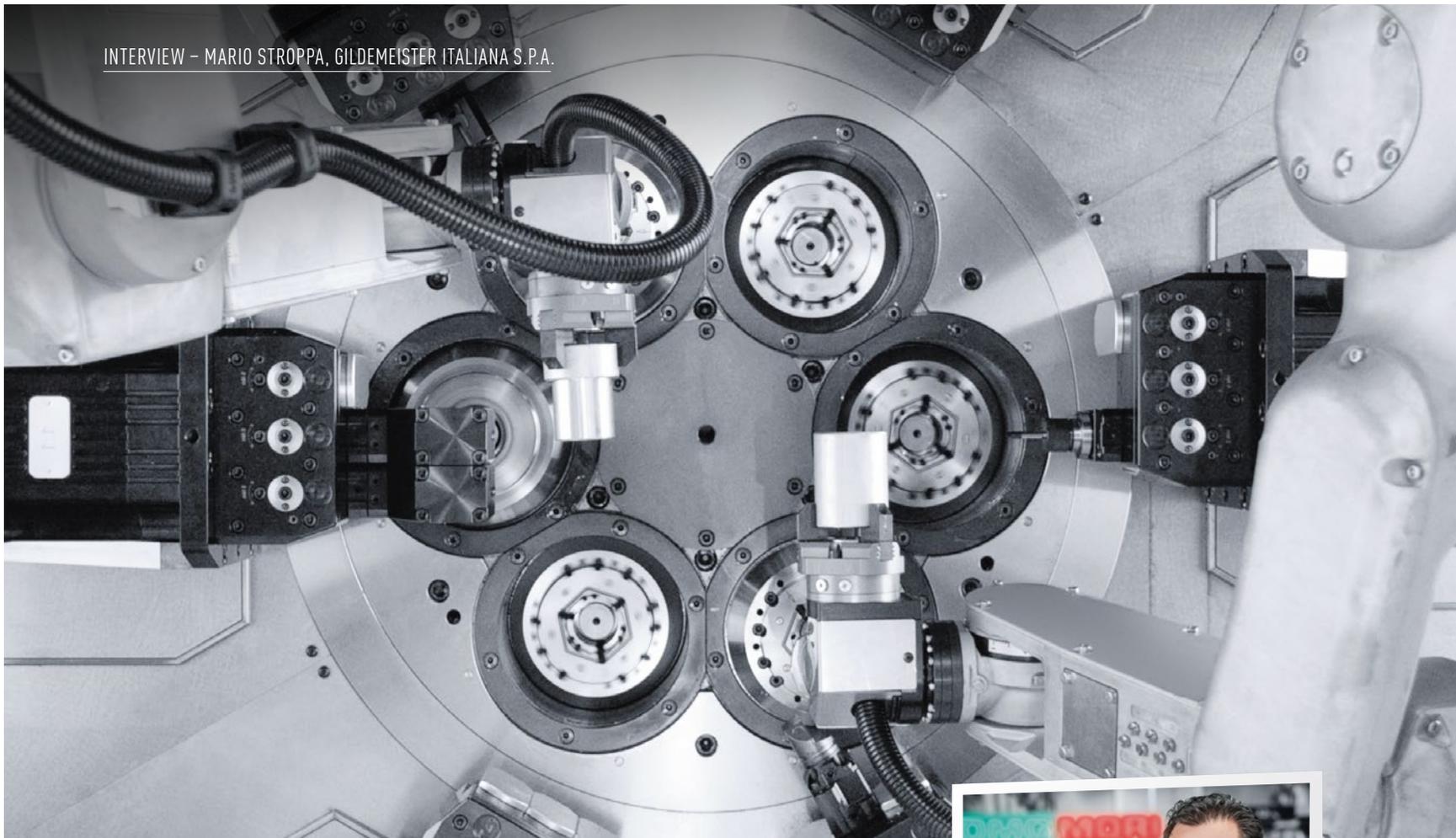
ADDITIVE MANUFACTURING

- + **LASERTEC 12/30**: Unique accuracy and productivity thanks to 35µm laser spot and rePLUG powder module
- + **OPTOMET**: “First time right” with innovative software for process and parameter optimization

Together with you, **our customers, suppliers and partners**, we can be proud of what has been achieved. We have an **exciting year ahead of us, full of new challenges**. We are prepared, with our unique combination of **dynamic and excellence** as the “Global One Company” and through collaboration with our **unique global value added network**.

Dr. Eng. Masahiko Mori
President
DMG MORI COMPANY LIMITED

Christian Thönes
Chairman of the Board
DMG MORI AKTIENGESELLSCHAFT



Machining of chuck components up to $\varnothing 50$ mm using up to two robots for simultaneous loading, unloading and turnover.



UNIQUE: SWISSTYPE

MULTI-SPINDLE AUTOMATIC LATHES

DMG MORI surprised international manufacturers of turned parts at EMO 2017 with the MULTISPRINT 36. The innovative concept integrates the proven SWISSTYPEkit with multi-spindle technology for the first time. The industry response was enthusiastic. For the first time, long and short turned parts and chuck components can be processed completely on one machine with high throughput and precision to microns.

Mr. Stroppa, the world premiere of the MULTISPRINT 36 was impressive.

What's the next step?

In line with our quality-based culture of innovation and integral "Quality First" objective, we will initially start off after EMO with selected pilot users in order to extensively test the MULTISPRINT prior to its international sales release. The results have been

impressive right from the start. So impressive that already more than 50 customers have decided on the MULTISPRINT after the sales launch. In addition to the commercial success, this is also an important milestone for the GITAL site in Bergamo, which was expanded and modernized at a cost of over 25 million euros in parallel with the development of the MULTISPRINT. All employees also identify 100% with the MULTISPRINT. They have the DNA of several thousand GITAL multi-spindle lathes and thousands upon thousands of single-spindle SPRINT machines.

What makes the MULTISPRINT 36 so valuable to customers?

Above all, four aspects are decisive for the unique added value.

The MULTISPRINT 36 is the only multi-spindle lathe that masters automated machining of chuck components in addition to short and long part turning from bar.

Mario Stroppa
Managing Director,
GILDEMEISTER Italiana S.p.A.

First: Customers expect the highest accuracy, micron-precise tolerances and maximum process reliability as the fundamental basis of their fault-free production. The MULTISPRINT can offer them all that.

Second: Alongside short part turning, the integrated SWISSTYPEkit also enables our customers to perform complete machining of 600 mm workpieces up to $\varnothing 36$ mm directly from bar – all fully automatically and to high precision using up to 41 axes. On top of this, setting-up from short to long part turning takes less than two hours.

Third: The MULTISPRINT makes it possible to manufacture chuck parts up to a diameter of 50 mm with micron precision. Up to two

robots can be installed directly in the work area to automate loading and unloading as well as to turn over the chuck parts.

DRIVEN TOOLS AND Y-AXIS IN ALL SPINDLE POSITIONS

Fourth: Added to this are the benefits of the two counter spindles, which have the same specification as the six main spindles. Along

with the equivalent of six small lathes for machining the front of components, we therefore also have two for machining the back.

The present is successful. How do you assess the future of the multi-spindle lathe?

Multi-spindle technology will retain its importance in the long term. Technological advances have always initiated a countermove when it comes to machine tools. Look at the change from CAM control to NC technology, for example. We expect the same effect in respect of the MULTISPRINT 36 – in the way in which it dramatically reduces the economical batch quantity based on the performance and flexibility of the processes.

«



MULTISPRINT

SWISSTYPEkit FOR WORKPIECES UP TO $\varnothing 36 \times 180$ mm IN LESS THAN 22 m² FOOTPRINT

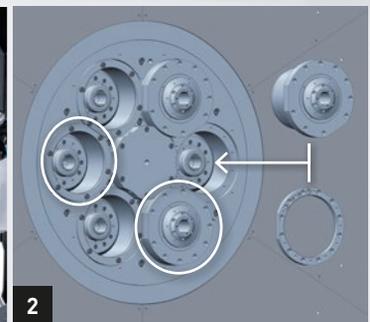
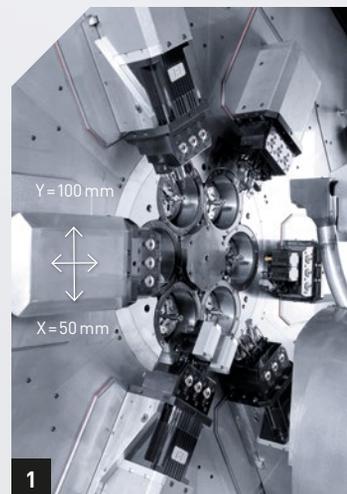
HIGHLIGHTS

- + Driven tools and Y-axis in all spindle positions
- + SWISSTYPEkit for changing from short to long part turning with set-up time < 2h
- + Short part turning up to $\varnothing 36 \times 100$ mm
- + Long part turning with SWISSTYPEkit up to $\varnothing 36 \times 180$ mm
- + Chuck components up to $\varnothing 50$ mm
- + Up to two robots for simultaneous loading, unloading and turnover
- + 25% shorter machine time with up to two counter spindles

SWISSTYPEkit:

STEERING SHAFT
(AUTOMOTIVE INDUSTRY)

Dimensions: $\varnothing 21$ mm \times L129
Material: 45S20
Cycle time: 14.1s



1. Unique: Y-axis with 100 mm stroke in all six spindle positions as standard
2. SWISSTYPEkit incl. driven guide bush for long part turning up to 180 mm

Chuck components:

VALVE BODY
(MECHANICAL ENGINEERING)

Dimensions: 120 \times 50 \times 30 mm
Material: AISI 316L cast iron
Cycle time: 75.0s



6-SIDED COMPLETE MACHINING

HIGHLIGHTS

- + NLX 2500 SY|700 with counter-spindle for 6-sided complete machining
- + Bar machining up to $\varnothing 80$ mm
- + Chuck components up to $\varnothing 366$ mm
- + 705 mm maximum turning length

BMT TURRET WITH 10,000 rpm

Improved machining capacity
and milling accuracy

BOX WAYS IN ALL AXES

Optimum damping characteristics
and dynamic rigidity

100 mm Y-AXIS

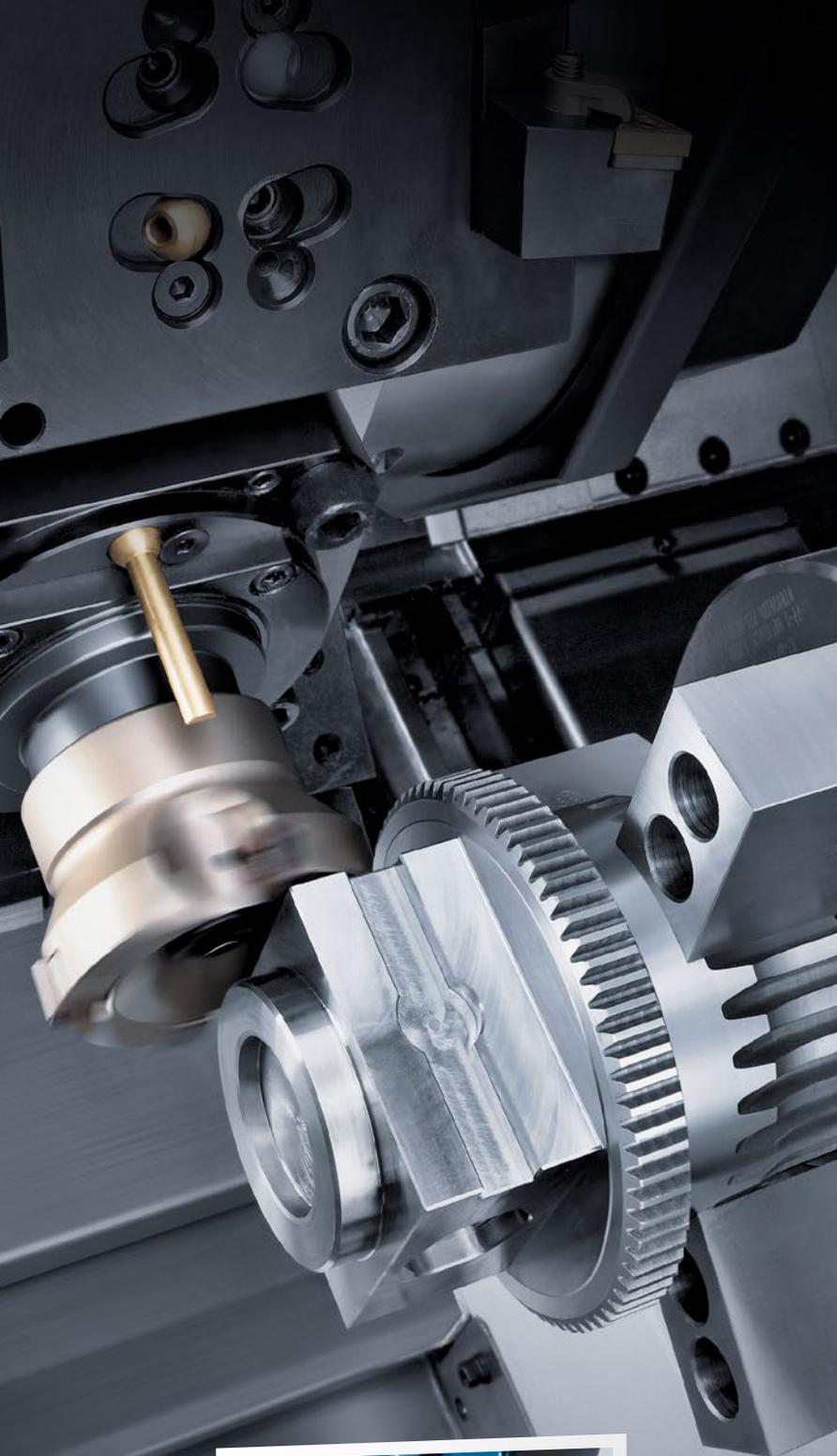
Eccentric machining

INTEGRATED AUTOMATION

Workpieces up to $\varnothing 200$ mm and 150 mm in
length, 2 x 10 kg maximum handling weight



NLX 2500 SY|700 with
GX10 T gantry loader.



**Exclusive technology cycle
DMG MORI Gear Hobbing**

- + Conversational programming of gear parameters
- + Spur, helical, curved teeth and worm gears possible
- + Hob and side milling cutter can be used
- + Tool service life maximized by shifting the milling cutter
- + Achievable quality \leq DIN 7

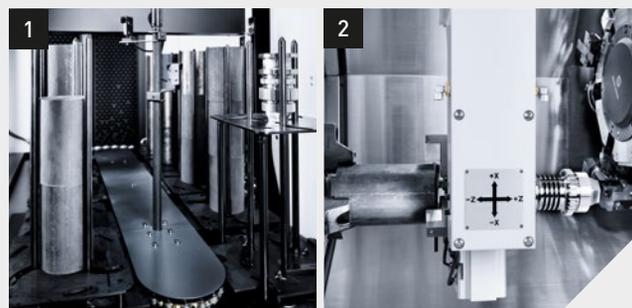


GX 10 T GANTRY LOADER FOR THE NLX 2500

INTEGRATED AUTOMATION – SIMPLE OPERATION DIRECTLY VIA CELOS

HIGHLIGHTS

- + Workpieces up to $\varnothing 200$ mm and 150 mm in length, 2x10 kg maximum handling weight
- + Stacking magazine with 2 loading stations and **10 or 20 pallet positions**; 75 kg load capacity per pallet position
- + High-speed loader: **75/90 m/min rapid traverse in X/Z**
- + Small interference contour due to loading arm with **integrated double gripper**
- + **Linking** of several machines possible via the gantry loader



1. Stacking magazine 75 kg load capacity per pallet
2. Double gripper with 2x10 kg load capacity



Find out more about the CLX series at:
nlx.dmgmori.com



Robo2Go 2nd GENERATION – FLEXIBLE WORKPIECE HANDLING, INTUITIVE OPERATION DIRECTLY VIA CELOS

MAPAL is one of the leading providers of precision tools for carrying out machining operations in the mechanical engineering, automotive and aerospace industries as well as in toolmaking and mold making. The MAPAL Group, founded in 1950, employs 5,250 people at subsidiaries in 21 countries. The high quality of the precision tools results from well trained and educated specialists and the use of innovative and efficient machine tools. Particularly in the soft machining area, MAPAL relies on lathes and turning-milling centers from DMG MORI. To maintain flexibility and long-term competitiveness in production, in September 2018 the company purchased a CTX beta 1250 TC from DMG MORI equipped with a Robo2Go 2nd Generation.

Flexibility plays a major role in the manufacturing of individually designed precision tools. "We are usually involved in the very early development phases of these special projects in order to develop an optimal production solution," explains Bernd Weiss, Production Manager, Sawmill, Turning Shop and Complete Machining at MAPAL. The company manages these projects from the concept to the finished tool.

Flexible robot automation as turnkey solution

Due, on one hand, to the great importance placed by MAPAL on the production facility in Aalen and the enormous competitive pressure on the other, the optimization of manufacturing processes has become part of day-to-day business. Dieter Berberich, Production Manager, Service, is responsible for resource planning, manufacturing technologies and maintenance: "With a total of 800 machine tools in Aalen alone, there is much potential for this optimization." MAPAL has therefore recently installed a CTX beta 1250 TC from DMG MORI in the turning shop and automated it with the Robo2Go 2nd Generation. "It was important to us that the machine supplier acted as a turnkey partner," he says, recalling the installation of the manufacturing solution.

Robo2Go – Simple operation without robot knowledge

Bernd Weiss believes the main argument for the Robo2Go 2nd Generation lies in the simple operation: "Our specialized personnel are able to use the Robo2Go without robot programming knowledge." Furthermore, with the second generation, DMG MORI has incorporated the Robo2Go into the CELOS

interface. As MAPAL is using the Robo2Go 2nd Generation as a pilot customer, there are regular exchanges with DMG MORI. "The feedback helps their application engineers to match the movement sequences of the robot even better to real working situations," adds Dieter Berberich. The handling of different components shows that there is already a great deal of intelligence in the Robo2Go 2nd Generation. A user interface defines the exact position of the workpieces. For different diameters, the robot automatically calculates the midpoint so that it always grips the parts precisely. "Precision is crucial when gripping because, for example, we manufacture tool bodies with tolerances down to hundredths of a millimeter," says Bernd Weiss.

Autonomous manufacturing made easy and convenient

Producing batch sizes of between 40 and 60 parts, the Robo2Go 2nd Generation works independently in the turning shop for up to ten hours. On weekdays, skilled staff are on site over three shifts, but unmanned operation particularly at the weekend gives additional capacity for more complex and expensive work.

Safeguarding jobs with flexible automation solutions

MAPAL sees automation as a great opportunity for the future. "For us, it is about retaining manufacturing in Germany," emphasizes Dieter Berberich. To do this, it is necessary to reduce manufacturing costs. "The Robo2Go 2nd Generation enables us to operate multiple machines, thus considerably increasing the productivity per employee." The skilled personnel have also long recognized the added value. In this way, MAPAL is confronting the shortage of skilled labor.

«



For different diameters, the Robo2Go automatically calculates the midpoint of the workpieces in order to grip them precisely.

MAPAL DR. KRESS KG FACTS

- + Founded in 1950 by Dr. Georg Kress; leading supplier of precision tools for machining
- + 5,250 employees in 21 countries worldwide
- + With 1,800 employees, the headquarters in Aalen is the group's largest site



MAPAL Dr. Kress KG
Obere Bahnstraße 13
73431 Aalen, Germany
www.mapal.com



CTX beta TC + Robo2Go



CTX beta 1250 TC

MAXIMUM FLEXIBILITY IN MANUFACTURING AND AUTOMATION

MAXIMUM MACHINE FLEXIBILITY

- + 6-sided complete machining
- + 100 % turning at up to 6,000 rpm
- + 100 % milling thanks to compactMASTER with 120 Nm
- + 100 % tools: 24 tools as standard, up to 80 tools optional
- + Technology integration:
Gear cutting, grinding, broaching

FLEXIBLE WORKPIECE HANDLING FOR SMALL AND MEDIUM-SIZED BATCHES

- + Rapid programming thanks to predefined program blocks
- + Rapid changeover from chuck to shaft part storage
- + Stacking magazine
- + Pressure reduction for thin-walled workpieces



Robo2Go 2nd Generation with chuck part storage

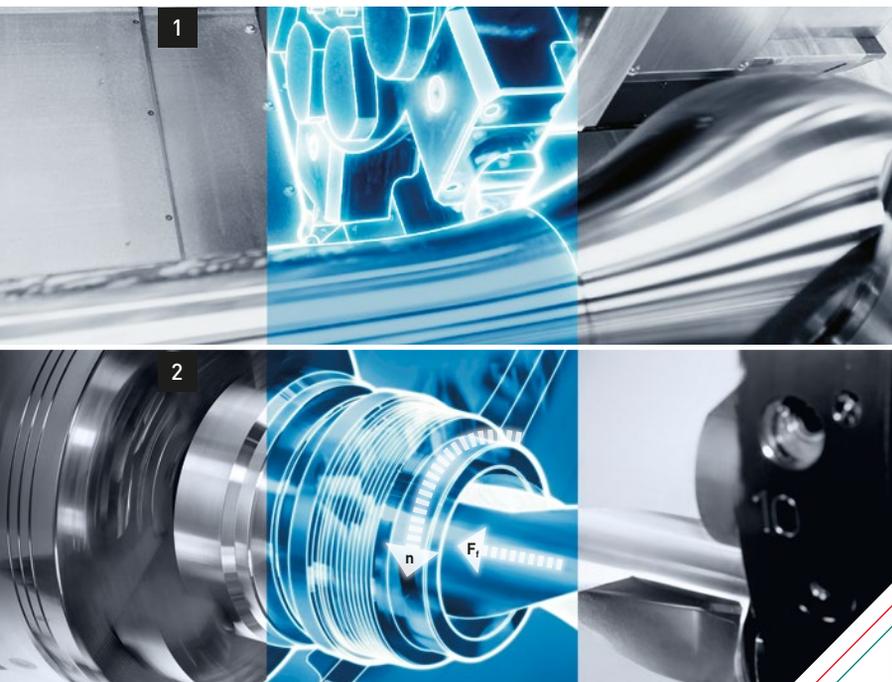


Shaft part storage
Shaft \varnothing 25 - 150 mm,
Chuck parts \varnothing 25 - 170 mm



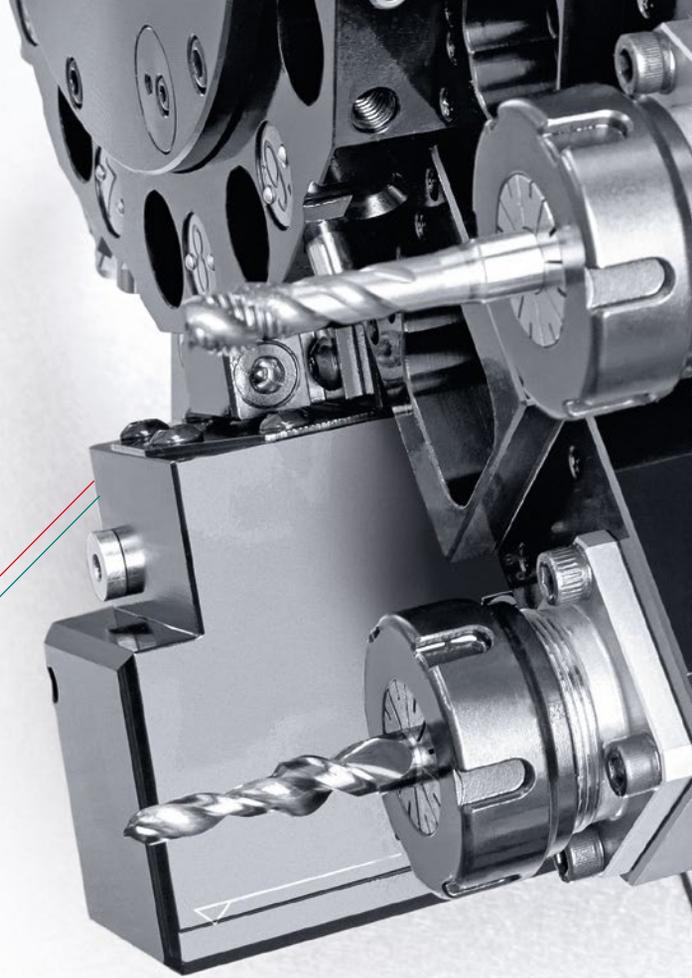
Programming screen for teaching robotic workpiece handling in <15 min

See for yourself!
The most flexible complete solution from a single source. Live presentations at exhibitions and technology centers - also in your area.



Selected DMG MORI technology cycles

- 1. Alternating speed:** Avoidance of vibrations through specific variation of speed
- 2. Easy tool monitoring:** Damage prevention in the case of tool breakage or overload



HIGHLIGHTS

- + Workpieces up to $\varnothing 400$ and 800 mm turning length
- + High-torque 4,000 rpm main spindle with max. 426 Nm and 25.5 kW (40% DC)
- + $\varnothing 80$ mm bar capacity, chuck diameters 210, 250 or 315 mm
- + 120 mm Y-axis* for eccentric machining
- + 6-sided complete machining using counter-spindle* up to 5,000 rpm, 192 Nm and 14 kW (40% DC), incl. Y-axis
- + **MAGNESCALE** linear encoders as standard:
V1/V3 version in the X-axis,
V4/V6 in the X/Y-axes (Z-axis*)
- + Available with **SIEMENS** or **FANUC**

*optional

CLX 450

6-SIDED COMPLETE MACHINING USING A COUNTER-SPINDLE AND Y-AXIS



CLX 450 with 800 mm turning length and counter-spindle.



You can find more on the subject of CLX at: clx.dmgmori.com

6-sided complete machining with counter-spindle and 120 mm Y-axis.



NEW

FANUC TOUCH FOR ALL CLX MACHINES

HIGHLIGHTS

1. 19" touch screen
2. DMG MORI applications with status icons
3. Standard FANUC CNC display in iHMI design (new user interface)
4. DMG MORI ASCII touch keyboard or machine functions (switchable layouts)
5. Operator panel with integrated handwheel
6. DMG MORI SMARTkey with 8 GB storage capacity



NEW

Robo2Go 2nd GENERATION FOR THE CLX

HIGHLIGHTS

- + Handling of workpieces up to $\varnothing 170$ mm
- + Three versions: Load capacity 10/20/35 kg*
- + Conversational control, no programming knowledge required
- + Modular gripper system, Internal and external gripper as standard (freely selectable)
- + For all CLX machines with SIEMENS and FANUC control

*only available for the CLX 450/550

HIGH-PRECISION VERTICAL MACHINING

THANKS TO C-FRAME DESIGN AND IT1 BALL SCREWS



Anja Mertens, Production Manager at DINSE and Jörg Möller, Team Leader.

In 1954, the development of welding cable couplings laid the foundation for the success of DINSE G.m.b.H. DINSE is one of the leading developers and producers of complete welding systems in the fields of MIG/MAG, TIG and laser. Innovative systems are developed at the company's headquarters in Hamburg, including manual welding systems as well as robotic and automatic welding systems for applications in the automotive sector, aerospace and ship building industries. Modern machine tools from DMG MORI ensure high standards of quality in production. Six models from the supplier were added to the shop floor recently, including two CMX 600 V centers.

The DINSE portfolio ranges from modular power sources to high-precision wire feeders and on to include customized welding sets. As a full-service provider of integral systems for industrial welding, DINSE brings together the entire product development process under

one roof. It is the reason why the Production Manager, Anja Mertens, places such importance on reliable and powerful machines. The high level of availability of the machines is the result of their high-quality build and the good service offered by DMG MORI: "These factors were decisive for the procurement of the two new CMX 600 V centers." The vertical milling machines have created additional capacity for efficient 3-axis machining.

CMX 600 V with production package for series production

DINSE uses one of the two CMX 600 V centers for series production and the development of innovative prototype products. "Our core competence lies in the development of customized solutions", points out Anja Mertens, indicating the multitude of different components. The second CMX 600 V is equipped with a production package for larger series. "A chip conveyor and a 40 bar internal coolant supply through the spindle ensure efficient

CMX U

PALLET HANDLING PH 150 – OPERATION DIRECTLY VIA THE CONTROL SYSTEM

HIGHLIGHTS

- + Operation directly via the machine control, no additional external control for automation
- + Max. load capacity 150 kg (250 kg as an option)
- + Clamping for 2 pallet sizes:
10 pallets 320 x 320 mm pallets, or 6 pallets* 400 x 400 mm
- + <40 sec. pallet change time
- + SCHUNK clamping system VERO-S with 32 kN clamping force; up to 112 kN with turbo function
- + Available for the CMX V and CMX U, DMC V and a number of other milling machines from DMG MORI

*optional





DINSE purchased two CMX 600 V centers for efficient 3-axis machining of prototypes and series parts.



The company uses the CMX 600 V among other machines to mill mounting brackets for a welding robot and folding brackets for tandem welding units.

chip removal, even where there is a high accumulation of chips”, says Jörg Möller, team leader in production.

High accuracy thanks to the C-frame design and IT1 ball screw drives

The sturdy C-frame design and X-axis table mean the CMX 600 V is configured for accurate machining. It is also equipped with linear scales, temperature compensation and ball screws in the top IT1 tolerance class. Its high level of accuracy and extremely extensive range of standard equipment plus numerous software and hardware options make the CMX 600 V a highly efficient vertical machining center.

Simple programming thanks to DMG MORI multi-touch control with SIEMENS

The ergonomic design of the vertical milling center and modern 3D control with simulation function both facilitate ease of use. DMG MORI can equip CMX V machines with

SIEMENS, HEIDENHAIN or FANUC. “As we work almost exclusively with SIEMENS, the 19” DMG MORI SLIMline multi-touch panel with SIEMENS was the obvious choice for us,” explains Jörg Möller. Having a vertical integration of 80 percent, DINSE is one of the few manufacturers of welding systems that produces exclusively in Germany. Anja Mertens is fully aware that: “Investment in modernizing the machines on the shop floor is necessary for us to operate more economically and keep production in Germany.”

DINSE GMBH FACTS

- + Founded in 1954
- + Sites in Hamburg and the USA, employees in Germany, Turkey, China, Poland, Russia and Scandinavia, sales and distribution partners worldwide
- + Production of innovative systems for manual, robotic and automatic welding for MIG/MAG, TIG and laser



DINSE G.m.b.H.
 Tarpen 36
 22419 Hamburg, Germany
www.dinse.eu



CMX V & CMX U

WH 15 CELL HANDLING SYSTEM FOR THE CMX V AND CMX U

HIGHLIGHTS

- + **Modular automation system** for workpieces up to 15 kg
- + **Workpiece magazine:** 2x up to 6x trays for 110 or 220 mm workpiece heights; trays: 600x800 mm, max. 250 kg load capacity
- + Incl. Kuka robot and SCHUNK single or double gripper, incl. customer-specific gripper jaws
- + **Expansion levels (optional):** SPC station, NOK chute, blow-off station and turn-over device



Availability	CMX 600 V	CMX 800 V	CMX 1100 V	CMX 50 U	CMX 70 U
WH 6 CELL	•	•	•	•	•
WH 8 CELL	◦	◦	–	•	–
WH 15 CELL	•	•	•	•	•

• available – not available
 ◦ WH 8 CELL: Only on request, technical clarification necessary from FAMOT due to restricted access of the robot to the work area

AUTOMATED PRODUCTION OF

HIGH-PRECISION AEROSPACE COMPONENTS IN 3-SHIFT OPERATION

With over 100 years of experience in aviation, PFW Aerospace GmbH is the longest established European company in the industry. The firm started out building aircraft for the First World War. Today, around 1,800 specialists at the headquarters in Speyer develop and manufacture complete pipeline systems for transporting fuel, water, oxygen, hydraulic fluid or bleed air, as well as complex structural components, for industry giants such as Airbus and Boeing.

A further 400 employees support the work at a location in Turkey. Another major production mainstay is the manufacture of fuel system connectors. PFW machines these in a highly automated system consisting of twelve DMU 60 eVo *linear* machines from DMG MORI, three robots and a high-bay storage facility for pallets with fixtures.

Twelve interlinked
DMU 60 eVo *linear*:
Maximum productivity
and 100 % reliability
from a batch size of 1.

Michael Säubert
Head of Machining at PFW



Source: aapsky/Shutterstock.com

Process-safe production of connectors with 95 % metal removal

The multitude of pipeline systems is not the top priority in the development of an aircraft. Rather, for example, the fuel lines have to be laid between the finished structural elements in the wings. This task is one of the core competences of PFW. The company develops and produces the necessary pipes and connectors. You will not find standard components here. "The wing of a A350 XWB alone contains 530 different connectors", explains Michael Säubert, head of the 90-strong machining

of metal removed is 95 percent. As all PFW products are safety-critical components, every part is tested for accuracy and the presence of cracks. "The aim is to identify and eliminate all causes of possible weaknesses in the manufacturing process", claims Michael Säubert. So all parts are numbered and the machining steps are completely traceable.

An end-to-end process chain is therefore required, from design through machining to quality control, and the production line has been optimized accordingly. Since 2013, PFW has continuously expanded and automated the production of the connectors for the Airbus A350 XWB.

»

FLEXIBLE
MANUFACTURING
WITH TWELVE
INTERLINKED
DMU 60 eVo *linear*

division. Airbus currently produces around 8 of the new wide-body aircraft a month, with this figure set to increase in the future. Complexity, high demands on quality and lightweight construction are the features that characterize these connectors. Programming alone takes around 40 hours: "The wall thickness of the aluminum components goes right down to 0.5 mm while all milling takes place from the solid." That is why the volume



Twelve DMU 60 eVo *linear* machines are linked at PFW via a pallet storage system with 743 locations.

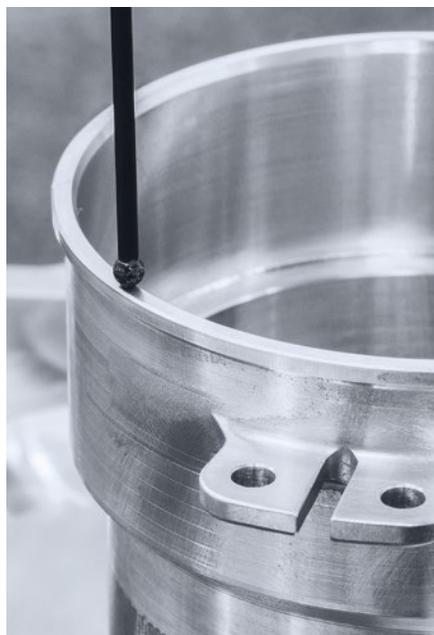


Michael Säubert (left), Head of the Machining Division at PFW, with his foremen Michael Kerner (center) and Max Reholz in front of one of the twelve interlinked DMU 60 eVo *linear* machines.

743 pallet locations for maximum flexibility with batch sizes starting at 1

Today, a total of twelve DMU 60 eVo *linear* machines are incorporated in the system. One robot is allocated to four machining centers, which it loads with pallets. Employees move the pallets complete with in-house designed fixtures into the high-bay storage via six load stations. There is space for 743 pallets. Production of the complex components requires five operations. Michael Säubert goes on to explain how the process is organized: "Each machine can produce every part and the pallets are clamped as required between the machining steps". Such flexibility is essential with batch sizes of 1 to 6. "The average throughput time of the connectors is around two hours."

"The machining time for the connectors was the decisive criterion for the investment", recollect Michael Kerner and Max Reholz,



The highly safety-critical connectors undergo a 100 percent check for accuracy and cracks.

PFW's manufacturing foreman. That is why they sent a reference part to potential machine suppliers. "DMG MORI machined the workpiece to the required quality in the shortest time". PFW also had several years of

**FINISHES TO
Ra 0,8 µm IN
5-AXIS PRODUCTION**

previous experience using machining centers from the machine tool manufacturer. 20 models from DMG MORI are in use in production at PFW. "This is, of course, indicative of a successful cooperation that has grown over many years."

*DMG MORI machined
the workpiece fastest to
the required quality.*

Michael Kerner and Max Rebholz
PFW's manufacturing foreman



There are 530 different connectors in the wings of an Airbus A350 XWB.



Linear drives for short machining times and surface finishes to Ra 0.8 µm

The fact that the DMU 60 eVo *linear* was chosen for this project was due to its outstanding dynamics. "The linear drives and high rapid traverse rates play a key role in the short machining times", says Michael Säubert. The accuracy of the machines is also impressive. "We have particularly high requirements in the area of finish quality in the range Ra 0.8 to 3.2". Another important point is the removal of the chips: "With our high metal removal rate, efficient chip evacuation is essential for process reliability."

Labor cost for system operation is low when measured against the number of workpieces. Six employees load the workpieces, perform small finishing tasks and inspect the parts. Production is carried out in three-shift operation, currently five days a week and in future six. Around 5,000 connectors a month

leave the plant for England, where they undergo surface treatment before being installed by Airbus.

Michael Säubert draws a positive conclusion after more than a year's production on the completely automated system. Set-up and finishing times are very short: "This together with a high level of availability of the entire process makes it possible for us to produce the connectors efficiently and competitively."

PFW AEROSPACE FACTS

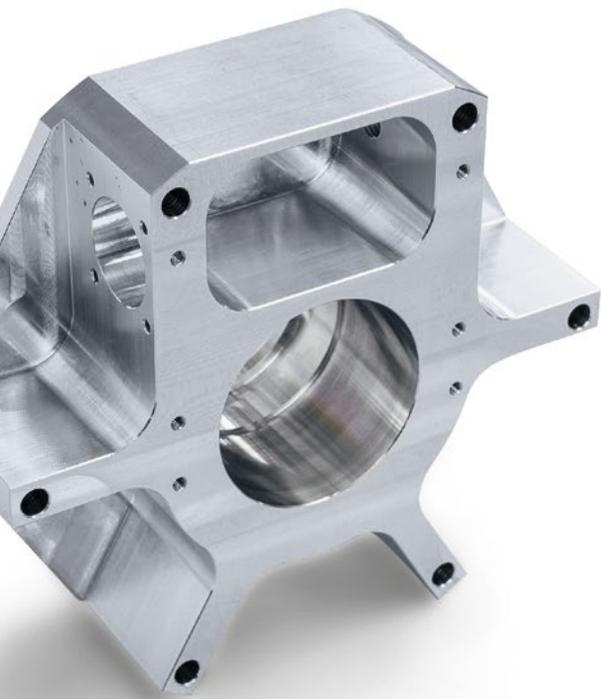
- + Supplier of key technologies to the aerospace industry
- + Machining of steel, aluminum, titanium and plastics (PEEK)
- + End-to-end service from engineering to series production support



PFW Aerospace GmbH
Am Neuen Rheinhafen 10
67346 Speyer, Germany
www.pfw.aero



AUTOMATION AS AN EFFICIENT SOLUTION FOR BATCH SIZES FROM 1 TO 10,000



Example of automated manufacture of precision parts at Mayer.

Mayer Feintechnik GmbH has come a long way since its previous manufacture of miniature furniture for model railways. Since it was established in 1951, the Göttingen company has continuously developed into a highly specialized supplier of precision components and assemblies. Following periods of rapid growth in the past, Mayer Feintechnik now has 110 employees. In a pioneering manufacturing facility in a new location built in 2018, these skilled engineers ensure that customers in the optical industry, laser technology and medical engineering benefit from integrated, high quality solutions quickly. Almost completely automated production using a total of more than 20 machine tools from DMG MORI guarantees productivity and competitiveness. The portfolio includes a MILLTAP 700 with WH 3 workpiece handling, three NMV 3000s each with a 34-position pallet storage system and three interlinked NH 4000s served by a linear pallet pool (LPP) with 48 pallets.

Mayer Feintechnik regards itself as both a manufacturer and a service provider. "We can only live up to the high demands of our customers if we operate as an integration-oriented system supplier", explains managing director Frank Neuschulz. "Thanks to our complete solutions, customers can concentrate on their core competences". Integrated customer orientation starts during the early stages of development: "Here we support developers and designers so that products are manufactured in a way that is as cost-effective as possible for everyone". The range of services goes all the way through to logistics. "In order to avoid having high stock levels here and at the customer's premises, we deliver just-in-time."

The customer-oriented business philosophy of Mayer Feintechnik has a direct influence on its way of operating. Since Frank Neuschulz took over the management of the company in 2004, when there were only 15 employees and a turnover of 1.9 million Euros,



Thanks to automated DMG MORI machines, we have been able to safeguard jobs and take on new skilled personnel.

Frank Neuschulz,
Managing Director

ongoing investments have been made in new personnel, continuous staff training and modern manufacturing technologies. Klaus Mayer, son of company founder Willy Mayer, acquired the first CNC machine from Japan at the end of the 1970s, reflects Frank Neuschulz: "The introduction of complete machining in a single clamping and automated machine tools have revolutionized our processes."

DMG MORI as a complete provider of automated manufacturing solutions

Frank Neuschulz wanted to collaborate with a partner who could provide everything from a single source during the automation of the manufacturing operation, i.e. machine tools, automation and tools. He found such a complete supplier in DMG MORI. "Mayer Feintechnik has been working with Mori Seiki lathes since 1989, later adding machining centers from DMG", says the time served toolmaker about the long-term cooperation. "Our low maintenance costs have always been an indication of the outstanding reliability of the machines". The machining quality has also always been impressive: "We consistently work to within an accuracy of hundredths of a millimeter when turning and milling."

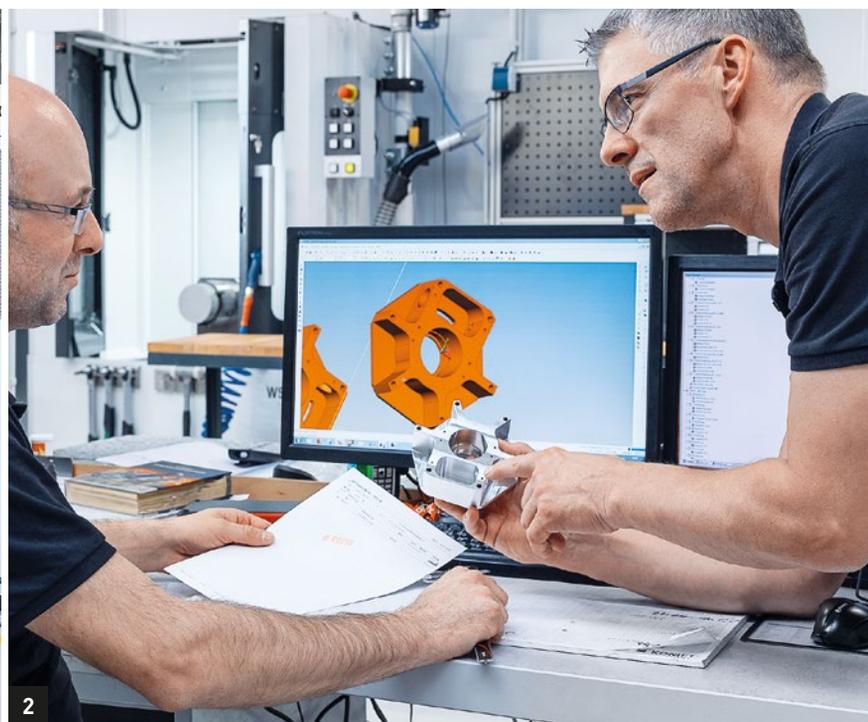
The reasons for automating the production were obvious to Frank Neuschulz: "In order to remain competitive, we had to increase our productivity without increasing labor costs, and flexibility has also become increasingly important. Batch sizes range from 1 to 10,000". Retooling-free concepts are also an important criterion: "In the Japanese Kaizen, retooling is known as Muza, which is translated as: waste", says Frank Neuschulz, who is a Japan enthusiast. He therefore introduced lean management at Mayer Feintechnik as well. "The time that we previously used for retooling is now used significantly more efficiently for programming and testing components."

Flexibility and productivity due to the interlinking of three NH 4000s

Frank Neuschulz considers the three automated NMV 3000s to be a good example of process optimization: "With 181 tools and 34 pallets, the 5-axis machining centers can be used in an extremely flexible way, especially for smaller quantities". In particular, the C-axis with up to 2,000rpm is used regularly for turning operations on milled parts. Since these manufacturing solutions reach their limits with large series production runs, Mayer Feintechnik recently invested in »



1



2

1. The manufacturing system with the 3 NH 4000s is about 30 meters in length.
2. Workshop-oriented interaction for integrated process optimization.



Documented top quality is an absolute must for Mayer Feintechnik in the area of service.

interlinking the three NH 4000s. The pallet store, which is almost 30 meters in length, has room for 48 pallets with tombstones which

4-AXIS MILLING MACHINES WITH UP TO 720 TOOLS AND 48 PALLETS

can be equipped with several workpieces simultaneously, depending on their size. 240 tools are available per machine, which reduces

retooling to almost zero. The employees prepare pallets at two set-up stations. As with the three NMV 3000s, every order can be processed completely in the flexible manufacturing system, says Frank Neuschulz, comparing the lines: "However, productivity is several times higher, which pays for itself by allowing larger series production runs."

Safe jobs and expansion thanks to automation

Mayer Feintechnik works in a similarly advanced way in the turning area. In 2018, two NZX 2000s were installed, systems which also efficiently machine complex parts in large quantities with their three turrets and bar loader. "Thanks to the automation solutions,

we are in a position to utilize the machines 24 hours per day and therefore also offer competitive prices", says a delighted Frank Neuschulz. Consistent orientation towards automation and Industry 4.0 contributes to further growth: "It's the only way we can ensure we do not lose orders to foreign companies. As a result, we will also be able to safeguard jobs in the long term and even take on new skilled workers."

«



Example installation, 4 x NH machines on an LPP.

MAYER FEINTECHNIK FACTS

- + Mayer Feintechnik was founded in 1951 and is a specialist metalworking subcontractor
- + Supplier of high-precision components and assemblies to the optical industry, laser technology and medical engineering
- + Two locations in multi-shift operation with approx. 110 employees

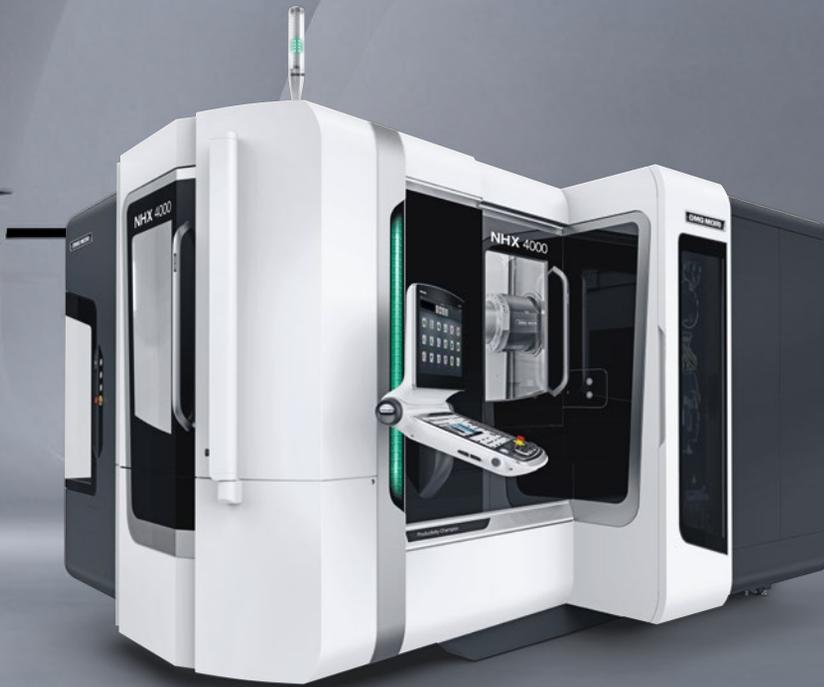


Mayer Feintechnik GmbH
Marie-Curie-Straße 1
37079 Göttingen, Germany
www.mayer-feintechnik.de



NHX 4000 3rd GENERATION

THE NEW STANDARD FOR
HORIZONTAL MACHINING CENTERS



7 OUTSTANDING TECHNOLOGIES AS STANDARD

1. **speedMASTER 20,000 rpm with 221 Nm**
 - 740 cm³/min in CK45
 - M42 drilling in CK45 (15,000 rpm with 250 Nm optional)
2. **toolSTAR magazine with 60 tool locations**
 - 2.2 sec. chip-to-chip time (NHX 4000)
 - Integrated tool breakage monitoring
3. **Chip conveyor with integrated tank and cyclone filter,**
and 15 bar internal coolant supply
4. **100 rpm NC swiveling / rotary table (DDM)**
5. **Advanced hydraulic clamping interface,**
as "Auto-Coupler" (from below) and fixed from above,
for more automation flexibility
6. Optimized cast components for improved dynamics and
stability, and **smartSCALE linear encoders from MAGNESCALE**
7. **CELOS with MAPPS on FANUC and CELOS with SIEMENS**

PRODUCTIVE AUTOMATION SOLUTIONS FOR HORIZONTAL MACHINING

RPS - ROTARY PALLET STORAGE

- + **Rotary pallet storage** with 5, 14 or 21 additional pallets,
up to 23 pallets in total
- + **500 × 500 mm** max. pallet size, **700 kg** max. pallet weight
- + **ø 800 × 1,000 mm** max. workpiece size



Prepared
for unattended
production!



CPP & LPP

- + **500 × 500 mm** max. pallet size, **700 kg** max. pallet weight
- + **ø 800 × 1,000 mm** max. workpiece size

CPP - Carrier Pallet Pool

- + Up to 29 pallets
- + Max. 4 machines with 2 set-up stations

LPP - Linear Pallet Pool

- + Up to 99 pallets on 2 levels
- + Max. 8 machines with 5 set-up stations



More on the subject of automation
can be found at:
automation.dmgmori.com



High-precision mold machining on a DMU 210 P.

UNIQUE PORTFOLIO FOR ENDLESS POSSIBILITIES



Anton Schweiger
Managing Director of
Schweiger GmbH & Co. KG.

DMG MORI focuses its decades of experience in tool and mold manufacture in the Die & Mold Excellence Center in Pfronten. This is where outstanding experts collaborate with customers to design made-to-measure manufacturing solutions.

End-to-end from trials to turnkey systems
The scope of the work ranges from machining trials with new tools and machining strategies to increasingly digitalized workflows and new technologies, for example from ULTRASONIC and

ADDITIVE MANUFACTURING to automated turnkey projects for production runs up to 7,000 hours a year and more. The customer is always provided with help in defining the key organizational steps so they can be implemented together.

As well as the expertise within the team and at the Pfronten site, the Die&Mold Excellence Center can fall back on a unique range of machinery, modules and options from DMG MORI globally (as the overview on the right impressively illustrates).

“The technical discussions with customers increasingly include questions concerning automation and digitalization”, reports Ralph Rösing, Managing Director of the Die & Mold Excellence Center.

The background is the trend away from manufacturing and towards industrialized tool and mold making. As the Managing Director of Schweiger Tool and Mold Construction GmbH & Co. KG and vice-president of the Verband Deutscher Werkzeug- und Formenbauer e. V. (VDWF –

DIGITAL EFFICIENCY IN 24/7 XXL OPERATION

Association of German Tool and Mold Making Companies), Anton Schweiger is aware of this. A peek into the 600m² XXL hall of his company, which started 24/7 operation about two years ago with DMC 270 U and DMC 210 U 5-axis gantry milling centers from DMG MORI, both of which are equipped with rotary pallet storage, gives an idea of the direction that is being taken.

It was the first implementation of a continuous automated process chain at the company, which is a single-source provider

of highly complex injection mold tools to the automotive industry. The digitalization ranges from CAD to CAM and simulation to adaptive process monitoring with MPC (Machine Protection Control). At the same time, the torque of the spindle drive is monitored, freedom from vibration is guaranteed and spindle diagnosis is carried out.

The result of the process reliability achieved makes impressive reading. Anton Schweiger says that each machining center achieves an operational capacity of 7,000 productive machine hours a year, with just one supervised shift per day.

SCHWEIGER FACTS

- + 75 employees
- + Highly complex injection mold tools
- + Tools weighing up to 30 tons
- + End-to-end solutions
- + XXL 600m² hall with 2 gantry milling centers (DMC 270 U | DMC 210 U)

SCHWEIGER TOOLS FOR SUCCESS

Schweiger GmbH & Co. KG
Rigistraße 6 – 8
82449 Uffing am Staffelsee
Germany
www.schweiger.tools



Ralph Rösing
Head of Die & Mold Excellence Center

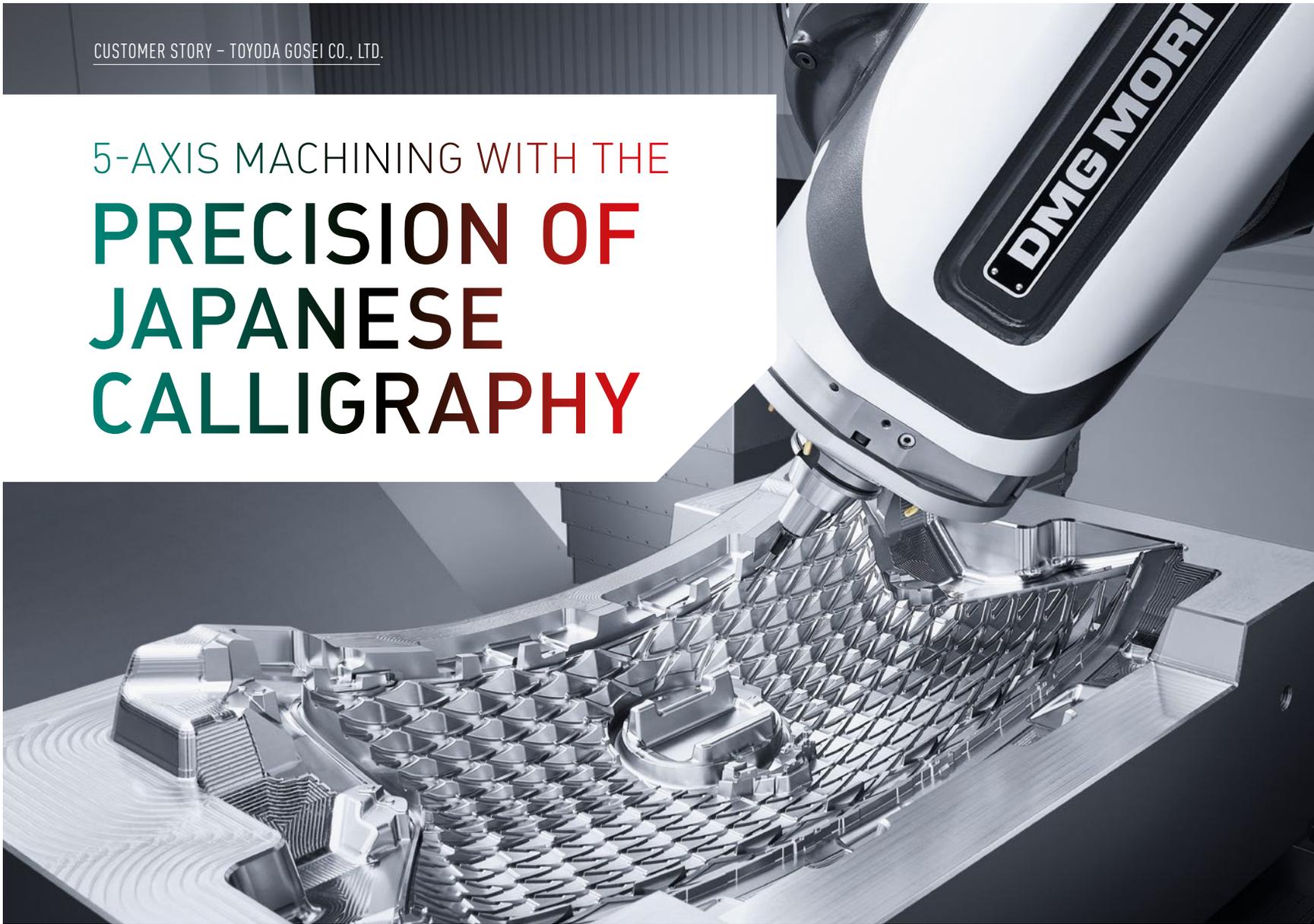
DIE & MOLD EXCELLENCE CENTER

UNIQUE – THE WORLD'S MOST EXTENSIVE PORTFOLIO AND KNOW-HOW FOR TOOL AND MOLD MAKING

- + **Over 50 years of experience gained from more than 20,000 successful technology projects worldwide**
 - BEST IN CLASS 5-axis milling for over 30 years
- + **Single-source provider for tool and mold making** – for small tool inserts in multi-cavity tools through to large dies for servo presses
 - Travels of 200 to 6,000 mm
 - Workpieces up to 150 kg
- + **Excellent surface finish Ra <0.15 µm and geometrical accuracy TCP <10 µm thanks to application-oriented and expansion options**
 - HSC spindles up to 60,000 rpm
 - Linear drives with up to 2g
 - Exclusive technology cycles, e.g. VCS Complete for up to 30% higher volumetric accuracy
- + **Integration of new technology processes**
 - ADDITIVE MANUFACTURING, Laser Deposition Welding (LDW) for wear-free forming dies
 - LASERTEC Shape for repeatable 3D laser texturing of free-form surfaces
- + **Integrated automation** for reliable and flexible production from a batch size of 1
 - Workpiece handling for small molds and mold inserts
 - Pallet handling for large molds and tools
- + **DMG MORI Software Solutions**
 - Automation of the vertical process chains through template-based CAD/CAM and simulation solutions
 - DMG MORI PRODUCTION PLANNING (ISTOS) to assist production planning
- + **Consultation in the Die & Mold Excellence Center**
 - Customer-specific application consulting to assist in developing the best machining strategy and tool combination for the respective machine
 - International teams of experts optimize, advise on and develop customer-specific technology project solutions



5-AXIS MACHINING WITH THE PRECISION OF JAPANESE CALLIGRAPHY



In order to reproduce exactly the design features created by the engineers, machining of the complex mold must be effected with absolute precision.

Toyota Gosei was established in the year 1949 by the Toyota Motor Corporation for the production of rubber components. The company manufactures automotive products such as weatherstrips, functional components and interior and exterior parts. Among the multiple factories, the Nishimizoguchi plant is responsible for designing and manufacturing molds as well as the production of equipment for making rubber and resin products.

Three large 5-axis machining centers from DMG MORI have been installed in the plant since 2007 – first a DMU 200 P followed by a DMU 210 P in 2015 and another in 2017: “Our aim is to manufacture high-precision molds on which all the features designed by the engineers can be realized and produced, and to do so at a low price”,

says Junichi Sato, Deputy General Manager of the Molds & Machines Manufacturing Division. In particular radiator grilles, the face of the car, have for some time had surprisingly impressive designs – the spindle-shaped radiator grille of the Lexus, for example, for which Toyota Gosei produced the molds.

“We can now machine our molds completely in one piece and in one set-up thanks to the 5-axis machines from DMG MORI.”

“We used to produce the large molds for a one-piece grille in individual segments weighing a maximum of five tons in different set-ups. We used electrical discharge machining for finishing the surfaces”, recalls Sato. This process has been completely optimized. “The large 5-axis machines from DMG MORI can now produce the molds

completely in one piece and in one set-up.” Time-consuming re-clamping is not only a thing of the past, but its absence is also a plus with regard to safety and reliability. “Compared to machines from other manufacturers, the DMG MORI models achieved by far the best cutting speeds and accuracies”, Sato gives as one of the reasons for deciding on the DMU portal machines.

20% shorter machining times due to complete machining

Koji Hayashi, Manager of Mold Production Section 1, explains the basic idea of the tool paths: “Creating paths for existing tools using CAM means that the motions and machining speeds of the cutters are partially restricted. To achieve more efficient machining we even develop suitable tools in house.” In contrast to the four tools required with the conventional



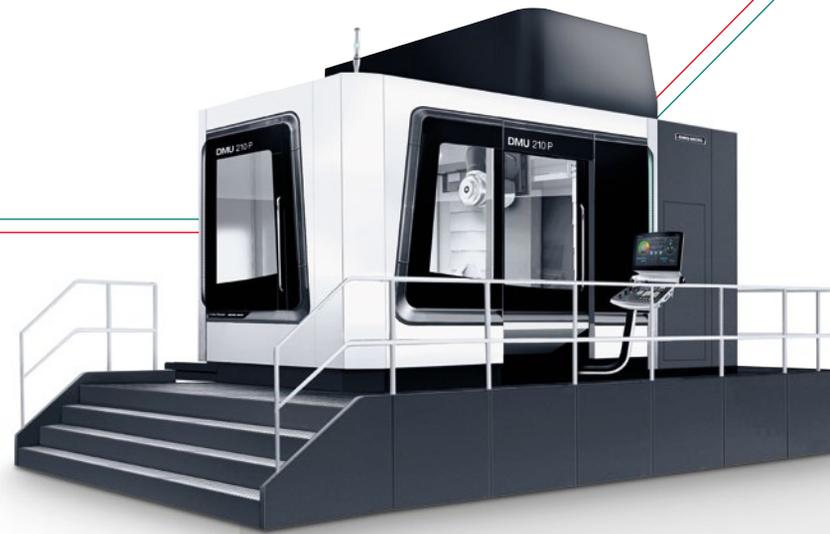
Our aim is mold manufacturing that applies the fine brush strokes of Japanese calligraphy to the movement of cutting tools.

Junichi Sato
Deputy General Manager
Molds & Machines Manufacturing Division

machining formerly used, only one tool is needed today, which of course results in a significant reduction in machining time. The same applies to surface finishing. "The time and effort involved in electrical discharge machining is now reduced thanks to the manufacturing quality of the 5-axis machines. We currently save 20 percent of the original overall machining time." In future the entire finishing process will be carried out on the DMG MORI machines.

5-axis machining with unbeatable ability

Toyoda Gosei stands for unbeatable ability in mold making with a high degree of design repeatability plus a favorable cost and delivery time ratio. The company produces complex molds for the Toyota Motor Corporation as well as for other manufacturers at home and abroad. "We will exploit 5-axis machining far beyond the boundaries of conventional mold making", says Sato about the future prospects of this technology. "Our aim is mold manufacturing that applies the fine brush strokes of Japanese calligraphy to the movement of cutting tools."



DMU 210 P

MORE THAN 1,500 PORTAL MACHINES INSTALLED

HIGHLIGHTS

- + Workpieces up to $\varnothing 2,500 \times 1,460$ mm and 10 t (8 t in the standard version)
- + powerMASTER motor spindle with 1,000 Nm and torqueMASTER gearbox spindle with 1,800 Nm
- + High dynamics up to 0.6g and rapid traverse rates up to 60m/min
- + 3-point support thanks to the inherently rigid machine bed, no foundation required
- + High temperature stability standard with positioning accuracy down to $\leq 10 \mu\text{m}$
- + High long-term accuracy due to cooled linear guideways and active spindle growth control



Members of the Mold Production team in front of the DMU 210 P that was installed in 2017.



CAM designers strive continuously to make tool paths with which they can exploit the possibilities of 5-axis machines to the full.

TOYODA GOSEI FACTS

- + Established in the year 1949 by the Toyota Motor Corporation for the production of rubber components
- + Toyoda Gosei is responsible for designing and manufacturing molds and production equipment for rubber and resin products



Toyoda Gosei Co., Ltd.
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Aichi 452-8564, Japan
www.toyoda-gosei.com



TEN DMG MORI MACHINES GUARANTEE QUALITY

FOR THE EFFECTIVE PRODUCTION
OF HIGH-ACCURACY MOLDS
AND TOOLS

Werkzeugbau LEISS GmbH has been a skilled and globally successful manufacturer of extrusion blow molding tools and stretch blow molding tools since 1994. The company, based in the Franconian town of Ludwigsstadt, develops new packaging designs in close collaboration with customers from the automobile, cosmetics, food and pharmaceutical industries. Quality is guaranteed by a powerful range of machines, which among others includes ten CNC machines from DMG MORI. Since July 2018, Werkzeugbau LEISS GmbH has increased its capacity in vertical machining with a DMC 1850 V from DMG MORI.

“As a competent service provider in the toolmaking sector, we see ourselves as a partner to our customers,” says Daniel Leiss, explaining the company strategy of Werkzeugbau LEISS GmbH. He runs the company together with his father, Fritz Leiss. These close partnerships begin with the development of new packaging designs. “The earlier we support the process with our experience, the more economical the production of the tools becomes.” Approximately 250 new tools with a total of around 1,000 cavities are developed each year. In addition to these are

The high stability and accuracy of the new DMC 1850 V has enabled us to reduce the finishing of tools to a minimum, especially in the field of large molds for long-stroke machines.

Daniel Leiss, Managing Partner
Werkzeugbau LEISS GmbH





The production of extrusion blow molding tools ranges from drilling and milling the cooling systems to roughing and finishing and thus requires universally applicable machining centers.



As well as the smaller vertical machining centers of the DMC V range, Werkzeugbau LEISS has also been using the large DMC 1850 V since July 2018.

peripheral components such as blowing mandrels or nozzles/cores and masks/ and punching units. A service department carries out the repair and maintenance of existing blow molds of the company's own manufacture or of external manufacture.

Minimal finishing thanks to high stability and accuracy

The machines owned by Werkzeugbau LEISS GmbH include seven vertical machining centers from DMG MORI's DMC V range, including the DMC 1150 V, the DMC 1450 V and also the new DMC 1850 V. The high-accuracy extrusion blow molds in particular represent a heavy load on the machine table. "The high accuracy of the machines reduces finishing to a minimum," says Daniel Leiss, referring to the final polishing of the molds.

"With the DMC 1850 V, DMG MORI has matched a proven machine concept to the increasing quality demands for producing larger and heavier components," says Daniel Leiss. The vertical machining center has an X-axis travel of 1,850 mm with 700 mm and 550 mm respectively in the Y and Z axes. The maximum load capacity is 3,000 kg.

Machine design for effective roughing and high-accuracy finishing

The one-piece cast iron machine bed, comprehensive cooling as standard and directly driven ballscrews along with linear scales as standard guarantee high precision and dynamics during the machining process. Wide guideway spacings also provide adequate stability for heavy-duty machining. The DMC 1850 V therefore ideally matches the requirements of Werkzeugbau

LEISS GmbH. "The stability applies both to 2.5D machining and drilling as well as to 3D roughing. But the machine is also impressive in 3D finishing with its accuracy and dynamics and is therefore suitable for use in all phases of tool production," says Daniel Leiss.

GOOD SERVICE, ATTRACTIVE PRICES

Good service, attractive prices and MASTER spindles with 36-month warranty

The performance and quality of DMG MORI machining centers have always been a decisive purchasing factor for Werkzeugbau LEISS GmbH. "But the service is impressive too," reports Daniel Leiss. DMG MORI can supply a replacement spindle within 24 hours. The 36-month warranty on MASTER series spindles – without any limit on running hours – is also a major plus point.

The DMC 1850 V is equipped with a 15,000 rpm inlineMASTER spindle as standard. Werkzeugbau LEISS GmbH uses the optional speedMASTER spindle with 20,000 rpm. A powerMASTER spindle with 288 Nm and a motor spindle with 40,000 rpm complete the range. The tool magazine with pockets for 30 tools provides high flexibility in day-to-day production. The vertical cover over the magazine protects against dirt and therefore increases service life.

Flexibility is an important catchphrase for Daniel Leiss: "The increasing service business in particular requires flexible manufacturing." Werkzeugbau LEISS GmbH educates highly skilled workers of the future in its own training shop. "Only competent staff are able to fully utilize the potential of good machine tools such as the DMC 1850 V."

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WERKZEUGBAU LEISS GMBH FACTS

- + Founded in Ludwigsstadt in 1994
- + 65 employees
- + Development and production of extrusion and stretch blow molding tools for the automobile, food and pharmaceutical industries



Werkzeugbau LEISS GmbH
Uferstraße 1–2
96337 Ludwigsstadt, Germany
www.leiss-gmbh.de



5-AXIS MACHINING OF MEDICAL IMPLANTS TO WITHIN MICRONS



Stem for artificial titanium hip joints.

With its focus on research & development and the production of artificial joints, the company LINK Orthopaedics China Co., Ltd founded in Beijing in 2009 is currently experiencing rapid business growth. As far as production is concerned, machine tools from DMG MORI support the continuous expansion of the product range and rising throughput. The stem for an artificial hip joint, for example, which is a leader in the medical technology sector, is produced by the company on a DMU 50.

LINK Orthopaedics China decided to use machine tools from DMG MORI after six employees went on training courses at Waldemar LINK in Hamburg in 2008. The German headquarters has been working with the machine supplier for many years. To ensure the continuous supply of the high-quality products between Germany and China, LINK Orthopaedics China adapted to German standards in its plant, which was established in 2009: technological processes, raw materials and machine tools.

make this product a highlight of our range.” They produce over 10,000 of these best sellers a year.

ACCURACY OF PRODUCTS FOR THE MEDICAL TECHNOLOGY SECTOR IS TO WITHIN MICRONS



LINK Orthopaedics China produces high-precision medical products on the DMU 50.

DMU 50: 10,000 hip prosthesis stems a year

LINK Orthopaedics China produces high-precision medical products such as artificial hip joints, knee joints and surgical instruments. The implants, in particular, require absolute precision. “This degree of accuracy is the main reason why we chose high-precision DMG MORI machine tools for production in China”, explains Andreas Nepl, Operations Manager at LINK Orthopaedics China. He shows the result using the example of a stem for an artificial hip joint produced on the DMU 50: “Quality and precision

The accuracy of the complex medical products from LINK Orthopaedics China is to within microns. Thanks to its high level of stability, the DMU 50 purchased in 2013 meets this requirement. Equally important is 5-axis complete machining in a single set-up. “This increases positioning accuracy, as there is no accumulative error due to re-clamping,” says Andreas Nepl. LINK Orthopaedics China also manufactures other products on machine tools from DMG MORI, e.g. hip joint cups on turn-mill centers in the NT series



Even in 24/7 operation our DMG MORI machines meet all demands with regard to availability and workpiece accuracies.

Andreas Neppl, Operations Manager
Mr Wu, Plant Manager

and joint heads and surgical instruments on NL and NLX turning machines. Here, too, Andreas Neppl stresses the precision of the machines: “The extreme rigidity of the machines ensures high long-term accuracy.”

24/7 production thanks to high machine availability

When necessary, LINK Orthopaedics China manages the high production throughput on the DMG MORI machines by working three shifts – seven days a week, around the clock. “Even with the machines under this constant load, the products always meet the demands regarding accuracy and surface quality”, claims Andreas Neppl. Equally important is the good service provided by DMG MORI: “Short response times within 24 hours ensure high machine availability.”

LINK FACTS

- + Founded in Beijing in 2009
70 employees
- + Subsidiary of Waldemar LINK GmbH in Hamburg
- + 1,000 employees at 20 locations in 17 countries
- + Production of high-precision medical products such as artificial hip joints, knee joints and surgical instruments.



LINK Orthopaedics China Co., Ltd.
No. 12 Bo Xing Yi Lu
Beijing 100076, P.R. China
www.linkorthopaedics.com



«

DMG MORI

TECHNOLOGY PARTNER

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For all materials.
For all processing methods.
For significant cost savings.
www.fuchs.com/de/en

LUBRICANTS. TECHNOLOGY. PEOPLE.



THE SEARCH FOR THE MICRON



Ralf Hecht (left), plant manager at Toni Behr and **Christian Retzlaff**, responsible for the DMC 125 FD duoBLOCK with integrated grinding technology installed in 2016.

Toni Behr Maschinen & Apparatebau GmbH has stood for top quality standards in machining for over 70 years. With around 40 employees, the contract manufacturer from Gräfelfing near Munich produces precision components for general mechanical engineering, the aerospace sector, measurement technology and the electrical industry. Toni Behr has many years of experience in turning, milling and grinding as well as modern CNC technology including 17 turning machines and machining centers from DMG MORI. The close collaboration with the machine tool manufacturer was further strengthened in 2016 within the framework of a development cooperation. Since then, Toni Behr has been using one of the first DMC 125 FD duoBLOCK machines with a grinding package including mechanical customisation as well as conversationally programmed grinding and dressing cycles.

“Our aim is to fulfil every customer requirement”, explains Ralf Hecht, plant manager at Toni Behr. “That’s why we have been machining to tolerances in the micron range for many years.” This experience extends across its entire range of services. When

ALL IN A SINGLE
SET-UP:
MILLING, TURNING
AND GRINDING

necessary, Toni Behr supports its customers early on in the development phase. “We can estimate what is feasible and point out new possibilities in the design.” The know-how and experience of its employees are key cornerstones



DMC 125 FD duoBLOCK including grinding package combines milling, turning and grinding in a single set-up.

in this customer-oriented philosophy, as Ralf Hecht assures us: "That it why it is so important to pass on this knowledge. By training the next generation, our requirement for skilled workers is met."

Apprentice training plays the same important role at Toni Behr as ongoing further technological education. "We can only remain competitive if we keep pace with developments in technology", believes Ralf Hecht. In the past, 5-axis technology, for example, and mill-turn machining revolutionized production processes, but Toni Behr went a step further in the year 2016. As part of a pilot project with DMG MORI, the precision machinists installed a DMC 125 FD duoBLOCK with integrated grinding capability.

Integrated technology for milling, turning and grinding in a single set-up

"We expected enormous rationalization from the combination of milling, turning

and grinding in one clamping", recalls Ralf Hecht looking back at the installation of the new development from DMG MORI. While the conventional process consists of turning and milling followed by a downstream grinding operation, – among others on machines from Taiyo Koki, a member of the DMG MORI Group – with the new DMC 125 FD duoBLOCK Toni Behr now has, for example, the option of drilling locating holes after grinding without having to reclamp.

Profile and positional tolerances to within microns by complete machining

"We now carry out the work steps that really matter, namely finishing and grinding, in a single set-up." The thermal stability of the machine has been further optimized thanks to a precision package with comprehensive cooling, so it now operates in a tolerance band of 20 microns, even in varying environmental conditions. "Grinding without any additional reclamping makes it far easier

EXCLUSIVE TECHNOLOGY CYCLE

GRINDING – MILLING

- + High surface quality through the integration of grinding technology
- + Grinding cycles for internal, external and surface grinding as well as dressing cycles
- + Acoustic sensing through the machine structure during wheel approach and dressing
- + 1,300l coolant system with integrated centrifugal filter
- + For filtering particles > 10 µm
- + AKZ nozzle unit optionally available for the best possible cooling directly at the point of grinding

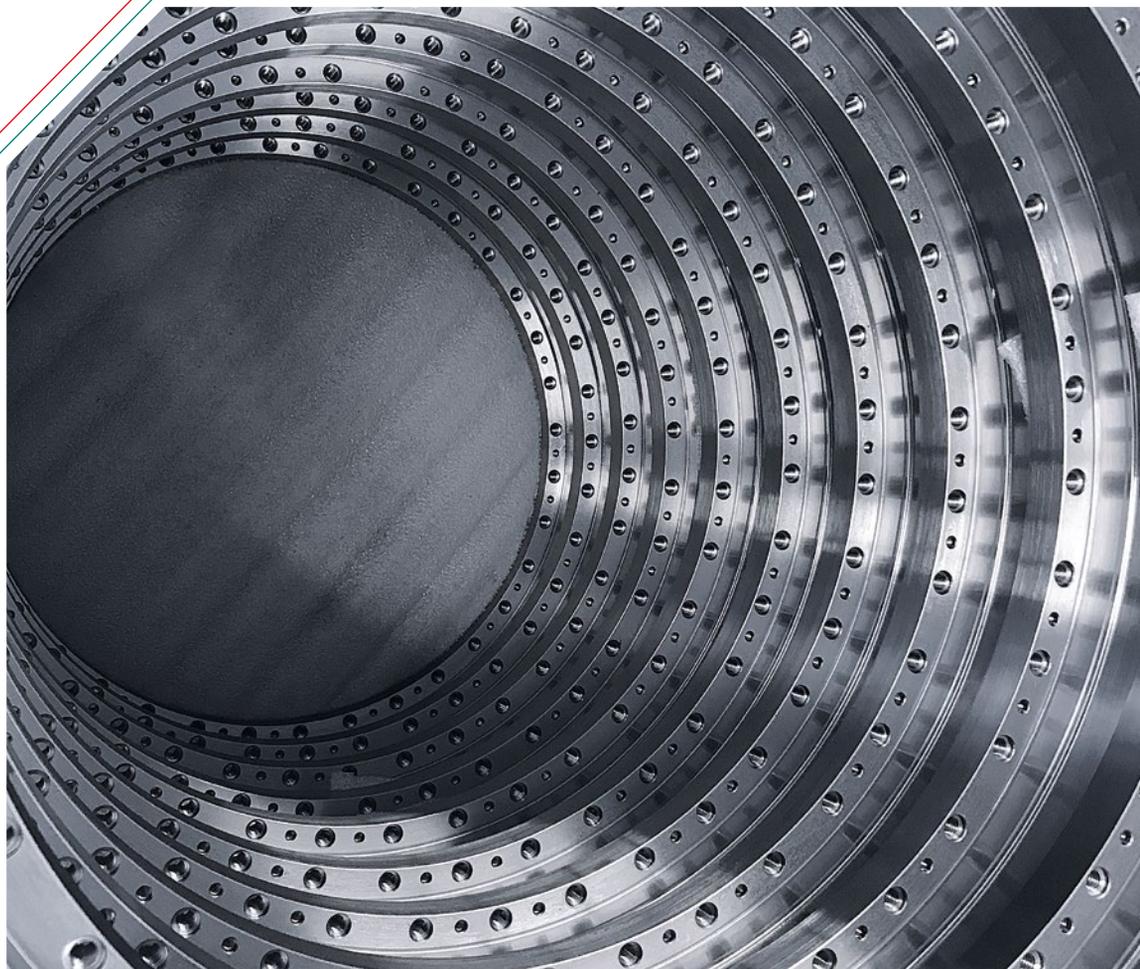


CUSTOMER BENEFITS

- + Surface accuracy up to < 0,4 µm
- + Concentricity < 5 µm
- + Quality 5 for $\varnothing < 120$ mm
- + Quality 4 for $\varnothing > 120$ mm



Find out more about the technology cycles at:
techcycles.dmgmori.com



to maintain geometric tolerances,” says Ralf Hecht. These tolerances lie within a few microns.

Up to 25% shorter throughput times

Grinding on a mill-turn machine opened up new possibilities for the operators, but also presented a challenge, Ralf Hecht goes on to tell us: “Two operators – one from the turning area and another from milling – are responsible for the DMC 125 FD duoBLOCK, so grinding was new for both of them.” They soon got the hang of things, so Toni Behr now benefits from the advantages of grinding technology integration. The machining results in particular are easy for Ralf Hecht to judge, because grinding is part of day-to-day business: “The grinding process on the DMC 125 FD duoBLOCK achieves results that can hold their own against any conventional grinding machine. And what is more, it also leads to a 25% reduction in our throughput times”.

Thanks to its pallet changer, the DMC 125 FD duoBLOCK facilitates well organized production processes. In many cases the components are clamped in special fixtures, which entails comparatively long set-up times. However, this takes place while the previous part is being machined. The operators are also responsible for the design and programming of the components. “They perform these tasks in SIEMENS NX-CAM while machining continues”, adds Ralf Hecht.

Turbine component for the aerospace industry, completely machined on the DMC 125 FD duoBLOCK.

Ensuring continued competitiveness

Toni Behr ensures its competitiveness by machining high-precision components. Ralf Hecht is convinced that the demands from customers are bound to increase, so technical advances such as the DMC 125 FD duoBLOCK including grinding will remain essential. Requirements are also rising in respect of the overall process. “Our plant has now reached its logistical limits”, explains Ralf Hecht as the reason for the company’s relocation in November 2018: “The new building with its larger production hall will help us to optimize our processes even further.” And there is another decisive benefit: “We will achieve micron accuracy even more easily in the fully air-conditioned production area.”

TONI BEHR FACTS

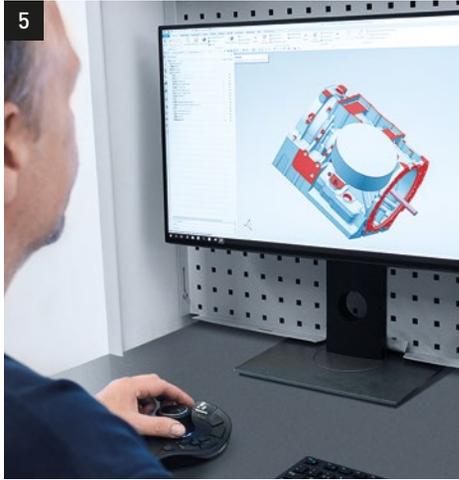
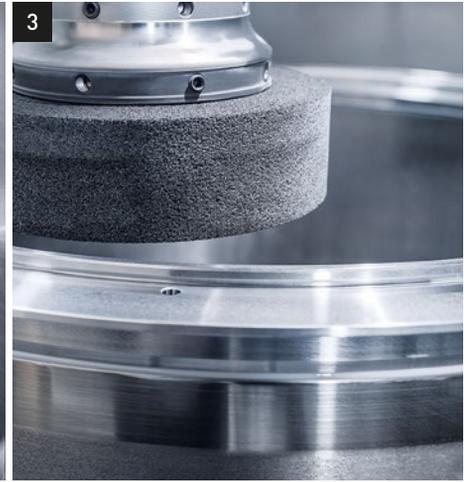
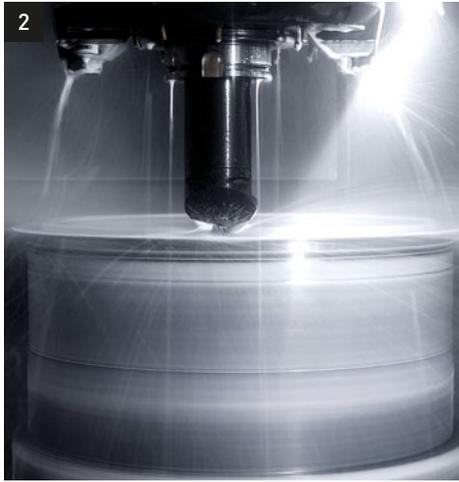
- + Third-generation, family-run business, founded by Anton Jakob Behr in Munich on 24th October 1945
- + Moved to a completely new and fully air-conditioned production hall in 2018
- + Specialist manufacturer of precision parts to an accuracy of up to 3 µm and of sizes between 60 mm and 1,250 mm



Toni Behr
Maschinen & Apparatebau GmbH
Seeholzenstraße 2
82166 Gräfelfing, Germany
www.tonibehr.de



«



1. The DMC 125 FD duoBLOCK is one of 17 DMG MORI machines on the shop floor at Toni Behr.

2+3. The DMC 125 FD duoBLOCK including grinding package combines milling, turning and grinding in a single set-up.

4. Toni Behr sets itself apart from the competition by achieving geometric tolerances of a few microns.

5. The operators program components using SIEMENS NX-CAM while machining continues.

6. With its pallet changer, the DMC 125 FD duoBLOCK enables setting up of the next part during machining.

SIEMENS
Ingenuity for life

“My machines?
Always well-equipped.”

[siemens.com/sinumerik](https://www.siemens.com/sinumerik)

A PORTRAIT OF

ADAMOS: MECHANICAL ENGINEERING SHAPES DIGITALIZATION

ADAMOS is the strategic alliance in the mechanical and plant engineering sector for the futuristic topics of Industry 4.0 and the Industrial Internet of Things (IIoT). The aim is to bundle the know-how of mechanical engineering, production and information technology. Together the partners intend to master the digital challenges and to develop IIoT solutions and products that are as collaborative as they are customer-oriented.



ADAMOS Hackathon 4.1, Pfronten, DMG MORI, January 2018

ADAMOS Hackathon 4.2, Bietigheim-Bissingen, Dürr AG, August 2018

ADAMOS: THE ONLY ALTERNATIVE AND MANUFACTURER- INDEPENDENT

The Digital Summit of the German Government that took place in Nuremberg at the beginning of December 2018 once again underlined how important the Internet of Things is for industrial development and the future significance of platforms, especially for medium-sized enterprises. And ADAMOS GmbH was right in the middle of all the action.

ADAMOS – THE STANDARD IN THE MECHANICAL AND PLANT ENGI- NEERING INDUSTRY

ADAMOS presented itself among other things within the framework of a panel discussion on “Platforms and Artificial Intelligence”. The Managing Director of ADAMOS, Dr. Marco Link, stressed the collaborative approach of the ADAMOS digitalization initiative “by mechanical engineers for mechanical engineers”.

The “collaborative mindset” was firmly embedded in the DNA of the enterprise at its foundation a year ago, he stressed. He also emphasized that ADAMOS is far more

than just a technological platform. On the contrary, ADAMOS keeps its customers constantly in mind and provides holistic support for their digital transformation.

Interdisciplinary approach with all ADAMOS stakeholders and their customers

“The digitalization of production can only be achieved on an interdisciplinary and customer-focused basis with all stakeholders”, believes Christian Thönes, Chairman of the Board of DMG MORI AKTIENGESELLSCHAFT and one of the founding members of ADAMOS.

As an example for DMG MORI, he mentions the service platform WERKBLiQ that will be available as a fully-integrated solution on the ADAMOS IIoT platform as of February. And it will be “manufacturer-independent for all ADAMOS stakeholders and their customers worldwide as far away as China”, he stresses (see also the WERKBLiQ Report on pages 44 and 45 of this edition).



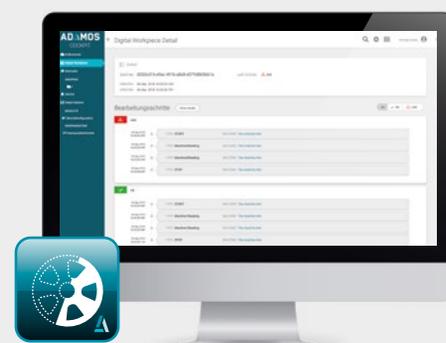
DIGITAL WORKPIECE

CO-INNOVATION IN ITS MOST CREATIVE FORM

HIGHLIGHTS

The “Digital Workpiece” collates data on a specific workpiece from different machines across different production steps. The idea for this co-innovation derives from an ADAMOS Hackathon.

- + **Overview** of all workpieces produced on selected machines
- + **Detailed view** of selected workpieces with the corresponding information across all machines and process steps
- + **Extensive API** for reuse by ADAMOS partners





ADAMOS offers the mechanical and plant engineering sector a unique combination of network and technology. ADAMOS currently has 10 partners, including among others Weber Maschinenbau GmbH and Mahr GmbH, and is open to further partners.

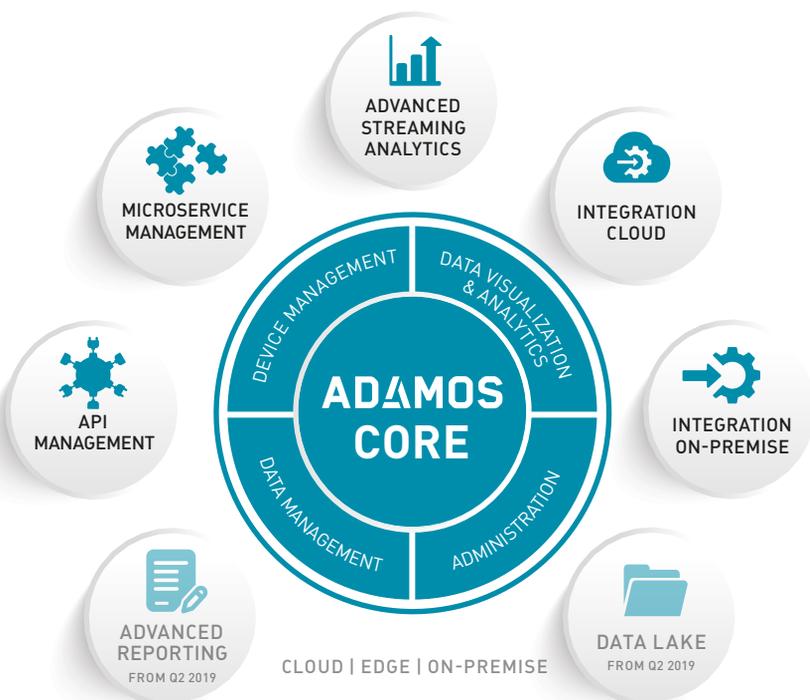
THE ADAMOS IIoT PLATFORM: SCALABLE, OPEN, LEADING EDGE



Dr. Tim Busse
Managing Director of ADAMOS
tim.busse@adamos.com



Dr. Marco Link
Managing Director of ADAMOS
marco.link@adamos.com



IIoT platforms provide the technical foundation for digital products and business models. They are the basis for linking millions of different machines, systems and equipment. The data gained in this way can be recorded, visualized and monitored via the platforms and can influence their process behavior. ADAMOS offers an open and manufacturer-independent IIoT platform for the processing of data and creation of digital applications.

ADAMOS IIoT platform

- + Modules with extensive functionality that can be used individually
- + Seamless integration of the modules for fast and simple application development
- + Continuous expansion of the modules

ADAMOS AT A GLANCE

- + **ADAMOS**
Collaborative digitalization initiative by mechanical engineers for mechanical engineers
- + **ADAMOS partner network**
Acceleration of innovation through cross-sector exchange of knowledge
- + **ADAMOS IIoT platform**
Extensive range of functions for the efficient creation of digital applications
- + **Applications**
Tailor-made for the mechanical engineering sector; individual and joint development for related problems

Manufacturer-independent and global, as far away as China

Dr. Tim Busse, Managing Director of ADAMOS as well as Head of the DMG MORI subsidiary WERKBLIQ GmbH, takes the opportunity to point out other partner- and customer-oriented ADAMOS attributes, such as the acceleration of innovation through cross-sector exchange of knowledge. He mentions the co-innovation project "DIGITAL WORKPIECE" in ADAMOS as a prime example. This enables the monitoring and documentation of all relevant workpiece information across all machines throughout the entire production process.

Other convincing ADAMOS partner references for customer-focused applications include "ECOSCREEN EQUIPMENT ANALYTICS" from DÜRR, "FACTORY CHAT" from ASM and diverse solutions from KM.ON Ecosystems, which belongs to the KARL MAYER Group.

In addition to its range of functions, the ADAMOS IIoT platform also offers various non-functional concepts, of course, for example multi-client capability, scalability and a high level of availability.

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CONNECTIVITY AS THE PREREQUISITE FOR THE INDUSTRIAL INTERNET

Dr. Tommy Kuhn
Managing Director of DMG MORI
Software Solutions GmbH



It became apparent last year that there is no alternative to digitalization, including for the machine tool manufacturing sector and its customers. We spoke about the next 12 months in an interview with Tommy Kuhn, the Managing Director of DMG MORI Software Solutions GmbH.

Dr. Kuhn, how would you assess 2018?

Digitalization has gained enormously in momentum. 2018 was most certainly felt by many to be the fastest year ever. The discussion about the pros and cons has become more objective when you leave all the hype aside.

Digitalization is understood across the board as a continuous and above all a highly individualised transformation process – with far-reaching interactions beyond the company's boundaries.

What does that mean exactly?

It means firstly that every company must design and accelerate its digital transformation in a way that is beneficial for its own company and its corporate aims. Digital applications for large companies with hundreds of machines and employees are quite different from applications suitable for small and medium-sized enterprises. But it also means that every company will

successively become an interactive part of a collaborative, value-adding network of products, services and data as a result of digitalization – with connectivity acting as the “eligibility to play” for participation in the Industrial Internet.

How does DMG MORI support its customers in the digitalization environment?

Keeping a balance between the traditional and the modern is important for us as a machine tool manufacturer. The name DMG MORI will continue to embody perfect manufacturing equipment in the field of metal cutting and advanced technologies such as 3D printing.

However, our customers can expect the same high quality from us when it comes to holistic and extensive support of their digitalization processes.

What do you understand by “holistic” and “extensive”?

Firstly, as a bi-directional machine interface our IoTconnector plays a strategic role on the path to the digital era, one whose importance reaches far beyond the shop floor. Where the machine is concerned, we use it to transfer statuses and countless sensor data, analyze these and based on the knowledge gained, progressively optimize the process – already partly adaptively in real-time.

With regard to the interaction between machine and tool, we know in a networked production environment which tools are located where, where tools are needed next and what the actual status of the tool is. This gives the customer all the information he needs for perfect capacity planning and tool logistics.

Looking beyond the machines and tools, with digital value creation there is an increasing tendency to focus on downstream processes – through to perfect orchestration of people, services and data in a digital factory and beyond into digital value-adding networks.

So there is no networking or connectivity?

Exactly. Every application level has its own connectivity requirements. Level 1, for example, involves remote support in the event of a service issue. Pictures and video streams are shared and the customer receives the support of an off-site expert quickly. This minimizes downtime.

Level 2 is for integration. In this case, files are shared between software systems and machines – such as the transmission of NC codes from CAM systems to machine controls. This reduces manual set-up times and accelerates process cycles.

Level 3 is for automation. We record basic machine statuses from the control, i.e. the internal workings of the machine, at one-second intervals. Data planning systems, maintenance systems and monitoring solutions alone can significantly boost the utilization of the machine, respond immediately to unscheduled downtimes and create transparency for all manufacturing operations at a central location. Things get significantly more complex in levels 4 and 5. This is where we begin to call up more sensor and job data from the machine every 100 down to 3 milliseconds.

With the corresponding analysis software, this enables a large number of predictions to be made about machine statuses, so

tool and adjust it adaptively while a process is running.

What should be the first step towards digitalization?

Important for getting started are a self-critical analysis of the current status of digital maturity and step-by-step planning with realistic targets.

Monitoring of machine performance is generally a good start with high utility because the collected information enables fast optimization of planning and maintenance processes.

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MONITORING IS THE ENTRY TO DIGITALIZATION

the customer can respond to unscheduled downtime even before it happens and thus prevent it, for example, or can measure a

CONNECTIVITY

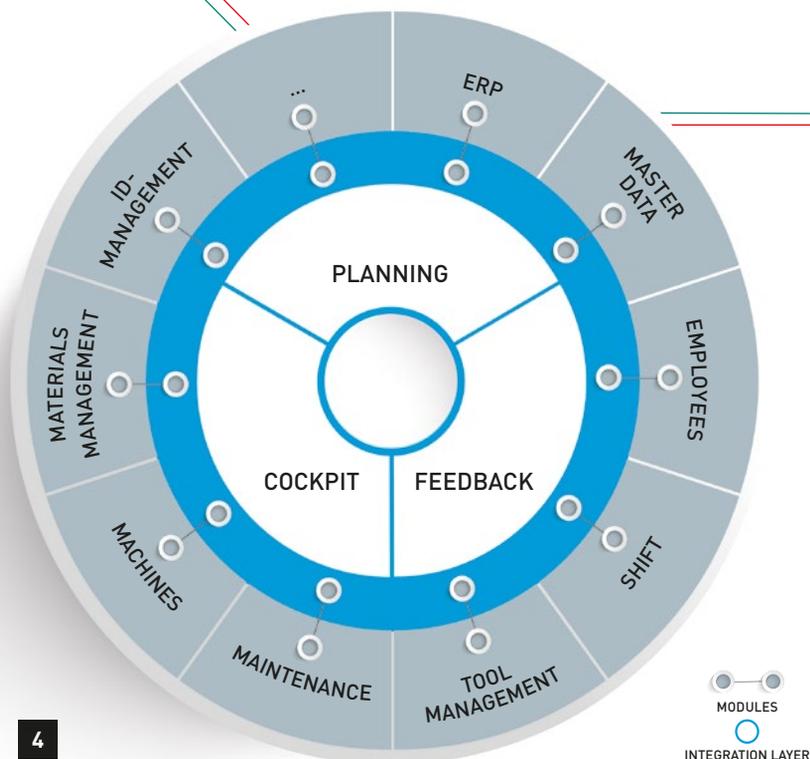




FAMOT GRAND OPENING WITH END-TO-END DIGITAL ADDED VALUE

Following an investment of more than 60 million Euros, DMG has expanded and sustainably modernized the traditional Polish plant in Pleszew, which was founded in 1877 and now boasts a total area of 50,000 m². The visitors invited to the Grand Opening ceremony between October 9 to 12, 2018 were shown around the impressive FAMOT digital factory and the new assembly hall, which has capacity for building more than 2,000 machines annually in the CLX, CMX V and CMX U series.

The FAMOT digital factory is the result of an intensive collaboration between the three DMG MORI subsidiaries ISTOS, DMG MORI Software Solutions and WERKBLiQ. The plant in Poland is impressive proof of the DMG MORI claim to be a customer-oriented partner and holistic pioneer of digital transformation. The digital modernization at FAMOT encompasses all levels of the added value chain. Networking with the DMG MORI IT infrastructure with regard to the order management, supply chain



1. CAD/CAM programming (here of the headstock of a CLX)
 2. PRODUCTION PLANNING: Order status for a DMC 340 U
 3. PRODUCTION FEEDBACK:
 Call up of order and program data on the DMC 340 U
 4. Micro-service architecture with the "Service Bus" as an integration layer

and customer relationship functions was a particularly decisive factor. No less challenging was the end-to-end digitization of all internal processes and systems – through to the integration of manual processes, in assembly for example. These two "main topics" were mastered with flying colors. A key element of the successful implementation is the so-called "integration layer" from ISTOS. This open interaction platform enables the integration of different plant-specific applications such as ERP, HR and tool management. It also includes production and machine data acquisition software, central status visualization as well as legacy data management and personnel resource planning. The web-based maintenance platform WERKBLIQ from the DMG MORI subsidiary of the same name also operates via the "integration layer".

The very heart of the digital transformation at FAMOT, however, is ISTOS PLANNING SOLUTIONS with the modules PRODUCTION

PLANNING, PRODUCTION FEEDBACK and PRODUCTION COCKPIT. This productive "triad" enables the end-to-end automation and optimization of all production planning processes, from detailed order scheduling and personnel resource planning right

END-TO-END-DIGITIZATION MADE BY DMG MORI

through to the visualization of production-relevant information in the graphical command station. As a fully integrated production planning and control system with a direct connection to all machines and work stations, ISTOS PLANNING SOLUTIONS enables extended planning and scheduling, direct feedback from the machine or from the work station and the monitoring of machine

and process-relevant data in real time. This allows FAMOT to visualize transparently production progress and to respond to changes immediately where necessary.

The end-to-end digitization of FAMOT together with the expansion of machining – which includes two DMU 600 P machines with double tables and a new XXL assembly hall – create a sound basis for the planned growth. By 2020, plant capacity will include 2,000 of FAMOT's own machine tools and an additional 2,000 prefabricated machine frames and other components and part sets for another 3,000 machine tools to be produced for various sister companies within the group.

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SHORT DELIVERY TIMES

THANKS TO 5-AXIS TECHNOLOGY AND PRODUCTION PLANNING FROM DMG MORI



Liebetrau is synonymous with precision and manufacturing quality.

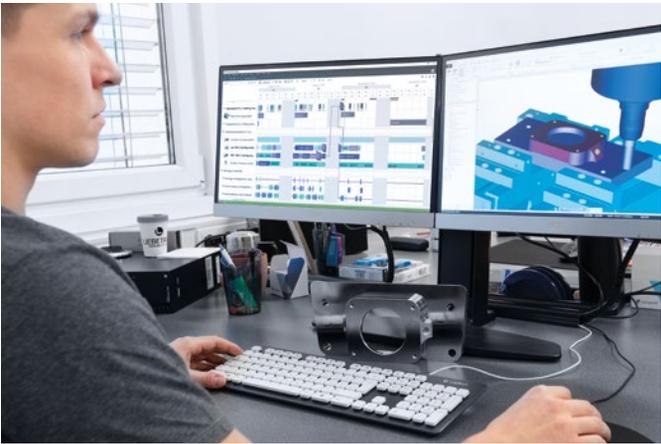
Fertigungstechnik Liebetrau pursues the vision of inspiring customers with tailor-made, high-quality production solutions. In Wutha-Farnroda, 28 highly trained specialists ensure that customers in industries such as medical engineering and vehicle manufacturing get perfect, precision components – from prototypes and assemblies to standard parts. Among others, Liebetrau uses a DMU 80 eVo with pallet changer, a DMU 60 eVo *linear* and, since 2017, a DMU 50 3rd Generation in its manufacturing facility. Rapid order throughputs and short delivery times are guaranteed by intelligent planning, which is organized fully digitally with the help of DMG MORI's PRODUCTION PLANNING package.

"As a service provider in the machining sector, we are not satisfied until our customers are satisfied," says Tony Liebetrau. He heads up the company together with Katrin Lippold. "As a production partner over the whole of the value-added chain, we concentrate the core processes in-house." We call this service from development to the manufacture of complete assemblies "ALL IN ONE". The most important core process by far at Liebetrau is the machining operation. The expertise of the staff as well as CNC technology are decisive factors for Tony Liebetrau: "High technical expertise and years of experience enable us to utilize the full potential of lathes and machining centers."

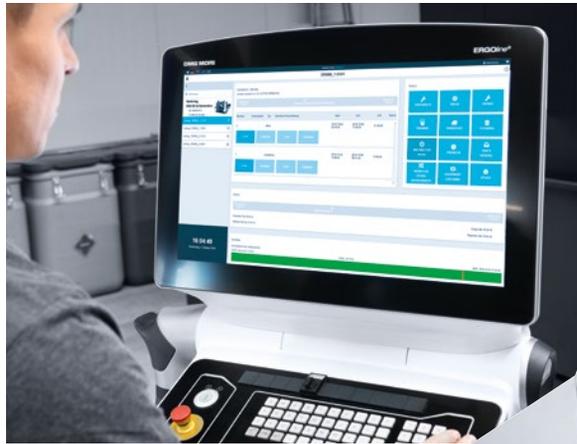


The versatility of the 5-axis DMU 50 3rd Generation and its high precision down to 5 µm fulfil all the expectations of a quality-oriented manufacturing facility.

Katrin Lippold and Tony Liebetrau
head up Fertigungstechnik Liebetrau



PRODUCTION PLANNING and PRODUCTION FEEDBACK enable continuous digitalization of the whole manufacturing process.



High-accuracy granulator for the pharmaceutical industry.



5-axis simultaneous machining to within hundredths of a millimeter

Liebetrau's machines are designed for maximum efficiency and the highest manufacturing quality. Worth mentioning in this regard are complete machining using turning-milling technology and 5-axis simultaneous milling as well as the DMU 60 eVo *linear* for its outstanding precision. In 2017, DMG MORI also installed a DMU 50 3rd Generation as a field test machine: "This has enabled us to provide direct feedback from practical use, which has contributed to improving the machine further," recalls Tony Liebetrau. The overall machine package impresses him: "The 650×520×475 mm work area and 300 kg maximum table load provide sufficient capacity for more than 70% of our components. At the same time, with a footprint of less than 6.7 m², the machine is very compact – a perfect ratio of manufacturing capacity to production area occupied."

"The versatility of the 5-axis DMU 50 3rd Generation and its high precision down to 5µm fulfil all the expectations of a quality-oriented manufacturing facility," concludes Tony Liebetrau. With a swivel range from -35° to +110°, the B-axis ensures maximum flexibility. An integrated cooling concept with, among other things, cooled table bearings, the one-piece machine bed, direct

ballscrew drives and linear scales in all axes guarantee the required precision. A speedMASTER spindle with 20,000rpm rounds off the specification of the DMU 50 3rd Generation.

Continuously digitalized production planning with DMG MORI

At Liebetrau, productivity relates to the whole process. In CAD/CAM programming, the company uses qualified technology partner, DMG MORI Software Solutions. Manufacturing orders are administered digitally. Furthermore, last year saw the introduction of DMG MORI's PRODUCTION PLANNING package. ISTOS, a subsidiary of the DMG MORI concern, has developed this intelligent planning tool as a link between order intake and production. "It enables us to plan production against limited capacity depending on the situation," says Tony Liebetrau, explaining the added value. Addition of the PRODUCTION FEEDBACK application enables agile planning and control of the whole manufacturing process. It reports actual production progress, for example via the CELOS operator interface, directly from the machine back to PRODUCTION PLANNING. "The result of this fully digitalized process chain is operating procedures that save resources and optimize costs."

Focus on automation and digitalization

Tony Liebetrau considers the future to lie in the digitalization of processes as well as in automated production: "We already use the pallet changer version of the DMU 80 eVo. The next step will be a further DMU 50 3rd Generation." This will be ordered with a PH 150 pallet handling system.

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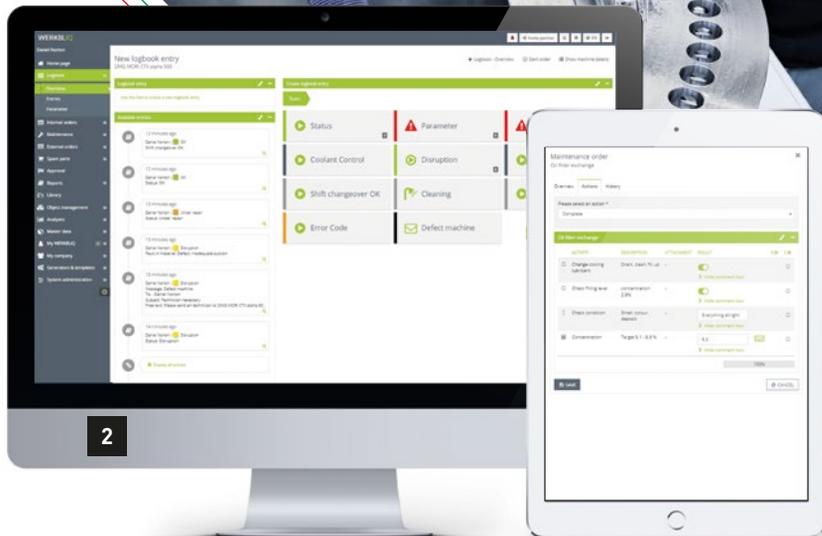
LIEBETRAU FACTS

- + Founded in 1992
- + 28 highly trained specialists
- + Precision components for the automotive industry, medical engineering and machine tool manufacture, among others



Fertigungstechnik
 Liebetrau GmbH & Co. KG
 Gewerbepark An der Allee
 An der Allee 10
 99848 Wutha-Farnroda
 Germany
www.f-liebetrau.de





1. Metalcutting is very important at ROMACO KILIAN, particularly with regard to high quality and knowledge-based components.
2. With the aid of a predetermined maintenance platform, WERKBLiQ leads you through all activities connected with the machines – incl. seamless documentation.

PLATFORM FOR DIGITAL SERVICE AND SHOP FLOOR MANAGEMENT

To digitally upgrade its entire site, since September 2018 ROMACO KILIAN GmbH in Cologne has organized its shop floor activities using the manufacturer-independent WERKBLiQ platform from the digital portfolio of DMG MORI. Head of Operations at ROMACO KILIAN, Heinrich Krull, discovered the system during the in-house exhibition in Pfronten at the beginning of 2018. The straightforward trial installation followed in March. What has happened in Cologne in the meantime is a success story that extends far beyond the original objective ...

ROMACO KILIAN is regarded as the epitome of top-class tablet presses. This particularly applies to the pharmaceutical industry. However since 1985, customers in the cosmetics, food and chemical industries have also appreciated the quality and reliability provided by the traditional company from Cologne.

Metalcutting has a high degree of relevance for product creation, particularly with regard to high quality and knowledge-based components. The company's capacity

currently consists of 10 machines – from a manual favorite to modern 5-axis machining. The plan is to gradually increase the number of CNC machines within the scope of a modernization and expansion program that is in progress. However, the focus is currently on organizational and structural improvement initiatives.

The WERKBLiQ platform has rapidly achieved strategic importance that goes far beyond what was originally expected of the system, explains Heinrich Krull, Head of



WERKBLiQ

WERKBLiQ provides well-organized dashboards with the most important key parameters of the workshop at the push of a button, including evaluations of machine statuses.

Operations at ROMACO KILIAN. The system was originally installed to better organize, document and evaluate the ongoing maintenance and service activities. The measures that were required, including set-up of the system and configuration of the action plans, were worked out by us. The knowledge that was missing was acquired simply by accessing video tutorials. An expert from WERKBLiQ was only on site at the end of the test phase, just before the project went live, in order to get to know ROMACO KILIAN and Heinrich Krull in Cologne.

Interaction via an iPad was as simple as the customization, which led to a high degree of acceptance among the employees. Meanwhile, the tablet has become an everyday piece of equipment. And that applies literally: ROMACO KILIAN uses WERKBLiQ document management to prepare zero point drawings and workholding specifications that previously required access to the central workshop computer.

Furthermore, a maintenance calendar in WERKBLiQ provides timely information about service work that is pending – including the correct contact person and contact information. All maintenance records and service reports, which previously were usually in a file that was difficult to locate in case of a query, are now also stored centrally in the system. Many communication tasks can also be carried out by the system:

from the shift pattern to the notice board, the employee receives all of this digitally on the tablet, which he or she needs for their daily work. Only the shop floor paperwork is still issued in paper form. For Heinrich Krull, the emphasis is on the word “still”.

This makes it clear that WERKBLiQ is more than a tool for digital organization of maintenance procedures and service processes. WERKBLiQ provides an “ALL IN ONE” solution on the shop floor. The employees also document the production and idle times of the machines, identify reasons for downtimes conversationally, acknowledge orders and record quality problems in procedures and processes. “We therefore have transparent, in-depth information with regard to key productivity parameters on the shop floor, which makes investment in expensive PDA systems unnecessary. It appeals to us as a medium-sized company”, explains Heinrich Krull with proud satisfaction.

And the Head of Operations does not think that the limits have been anywhere near reached. “We open up new horizons on an almost weekly basis by taking a closer look at the possibilities”, confirms Heinrich Krull. He takes the opportunity to give extra praise for the willingness and agility of the WERKBLiQ team: “If we come up with an idea, the improvement is normally implemented in the following release”. He has personally come to appreciate the convenient

possibilities of statistical analyses. “Status presentations for the company management are prepared perfectly in a few minutes and certification audits can be more or less prepared at the push of a button”, concludes Heinrich Krull. As a result, we didn’t bother to ask about amortization ...

«

ROMACO KILIAN GMBH FACTS

- + 1875 Established in Berlin, 1948 Moved to Cologne, 2013 Incorporation in the ROMACO Group
- + 180 employees
- + Machine series, high-speed tablet presses, standard tablet presses, single-punch laboratory tablet presses
- + More than 3,000 machines manufactured



ROMACO KILIAN GmbH
Scarletallee 11
50735 Köln, Germany
www.romaco.com



DMG MORI NETservice

FOR INCREASED MACHINE AVAILABILITY AND LOWER SERVICE COSTS



In combination with the SERVICEcamera, NETservice provides quick machine availability in the event of service.

Established in 1978, A/S Rolf Schmidt Industri Plast from Kolding in Denmark manufactures sophisticated and high-precision workpieces made from thermoplastics. In close collaboration with the food industry, 55 employees ensure that processes run efficiently and that a high degree of customer satisfaction is provided. From a technological standpoint, A/S Rolf Schmidt Industri Plast uses five DMG MORI machining centres, amongst other equipment. A CMX 50 U and a DMU 50 3rd Generation were installed in 2018 – the latter together with NETservice and SERVICEcamera from DMG MORI to restore machine availability quickly and easily, even in the event of service.

Managing Director Flemming Andreassen considers a high degree of customer focus to be the secret of the success behind the positive business development of A/S Rolf Schmidt Industri Plast: "Manufacture to delivery seldom takes more than five days". He also thinks that quality requirements with accuracies down to hundredths of a millimeter are a challenge in the machining of thermoplastics. "The material is more difficult to work with than metals". Customer orientation also means good service as far as Flemming Andreassen is concerned: "Our failure rate is minimal. If a part doesn't fit, we make a replacement immediately and deliver it within a day – without discussion". Excellent service is also a decisive factor when purchasing a machine tool. "When you

ALL IN ONE PACKAGE

MONITORING & SERVICE PACKAGE

- + **NETservice** – less machine stoppage time with the new remote service
- + **MESSENGER** – Live monitoring of your machines
- + **PRODUCTION COCKPIT** – View of the big picture
- + Optional: **SERVICEcamera** – Faster help by means of optimum fault finding
- + Optional: **Retrofit kit incl. IoTconnector**

Free under warranty for new machines with IoTconnector.



With SERVICEcamera, the operator transmits live images from the machine to DMG MORI service experts, which makes rapid fault diagnosis possible.

The use of SERVICEcamera makes quick and accurate identification and problem solving possible.

L to R: **Flemming Andreassen**, Managing Director and **Jesper Lyngsø**, Production Manager, A/S Rolf Schmidt Industri Plast and **Henrik Juncker**, Service Solutions Manager, DMG MORI

are working two shifts, every stoppage results in significant losses". DMG MORI quickly proved itself to A/S Rolf Schmidt Industri Plast with regard to service, as production manager Jesper Lyngsø reports: "Rapid reaction times and straightforward support ensure that we can continue manufacturing very quickly at all times."

Quick troubleshooting thanks to live images from SERVICEcamera

To optimise the service process further, A/S Rolf Schmidt Industri Plast uses DMG MORI NETservice on the DMU 50 3rd Generation. In combination with SERVICEcamera, many problems can be identified significantly more quickly than before. "The service engineer often had to

travel to site twice – initially for troubleshooting and then again to install the spare parts", says Jesper Lyngsø. "SERVICEcamera allows us to transmit real-time images from the machine to the service experts on the DMG MORI hotline". This has advantages for both parties. The operator is quickly connected to the next free service expert. If a service engineer is required, he can be dispatched by DMG MORI with the required spare part. This avoids unnecessary travel and increases the availability of the service engineer. The cost of the service is therefore reduced for the customer and the machine is up and running again more quickly.

Competent problem solving in a multi-user conference

SERVICEcamera and NETservice complement each other perfectly. During a multi-user conference, operators, service specialists and service engineers communicate with each other and follow live images from the SERVICEcamera. "If necessary, experts from the relevant DMG MORI production plants can be involved", adds Jesper Lyngsø. The combined know-how can speed up the solution to the problem considerably. A whiteboard in NETservice rounds off the scope of functionality. The participants in the conference share the live transmission or circuit diagrams and make markings on a digital sketch. Jesper Lyngsø: "Many faults can be remedied in this way, meaning that we don't need a service engineer on site at all in an ideal case". Either it is sufficient to instruct an operator, or DMG MORI experts provide assistance by accessing the machine remotely.

"The first machine is sold by sales; the second is sold by service"

Flemming Andreassen thinks that the good experience with DMG MORI service will continue to play a role in the future: "The first machine is sold by sales; the second is sold by service". NETservice is proof that DMG MORI works just as innovatively in the after-sales area as in product development.

ROLF SCHMIDT INDUSTRI PLAST FACTS

- + Established in 1978 in Kolding (Denmark)
- + 55 employees
- + Manufacture and assembly of thermoplastic workpieces within a few days



A/S Rolf Schmidt Industri Plast
Jernet 4H
6000 Kolding, Denmark
www.rsip.com





INTEGRATED SERVICE CONCEPT FOR INCREASED PRODUCTIVITY



The equipment operated by Tesla Grohmann Automation includes 40 machines from DMG MORI.

Even before being taken over by Tesla, Grohmann Engineering GmbH, founded in 1983, was a leading company in the design and implementation of automation solutions. Today, around 1,000 employees work at the head office in Prüm and at the Neutraubling site where they develop, manufacture and erect assembly lines. Among others, 40 machine tools from DMG MORI in the production area guarantee the required productivity in this fast-moving sector. An integral part of the collaboration with the machine tool manufacturer are the full service contracts, which reduce unplanned machine downtime to a minimum.

Thanks to DMG MORI's full service contracts, 100 % of the costs are met in the event of a crash – with immediate settlement of claims.

Manfred Engeln
Production Manager Tesla Grohmann Automation



As an experienced DMG MORI service engineer, Arno Kwast is regularly on site maintaining DMG MORI machines.

Short response times are crucial for Tesla. This requires a high level of expertise from the staff as well as totally reliable production. Tesla Grohmann Automation has therefore invested in both personnel and technology. "We are continuously searching for competent specialists and invest considerable time and money in the training and further education of our employees." In addition, it is essential that the machine tools in the production area operate efficiently. "This applies both to newly purchased and to existing models." The company's machines encompass 40 models from DMG MORI. These include nine recently purchased DMC 1150 Vs, five CTX beta 1250 TCs

and two DMF 360 *linears*. Furthermore, several DMC 60 monoBLOCKs with RS3 rotary pallet storage systems ensure highly automated production.

Jointly developed service strategy

In 2016, Tesla Grohmann Automation began collaborating closely with DMG MORI with regard to service issues in order to maintain machine availability constantly above 95 %. Together, a strategy was developed which made it considerably easier to plan Tesla Grohmann Automation's production as well as DMG MORI's service visits. This strategy was based essentially on an analysis of

INVESTMENT IN PERSONNEL, MACHINES AND MAINTENANCE

the actual situation. The results led to a systematic refurbishment of all existing machines to bring them to a technically perfect condition.

»

DMG MORI SERVICE

ALL-ROUND WORRY-FREE PACKAGE FOR YOUR NEW MACHINE!

FULL-SERVICE

- + All service and spare parts costs included
- + **No unexpected repair costs**
- + Annual manufacturer's service and **machine breakdown insurance** included
- + **All services "from a single source"** meeting the quality standards of the manufacturer, DMG MORI
- + **DMG MORI Full Service** can be financed easily at the same time as purchasing your new machine

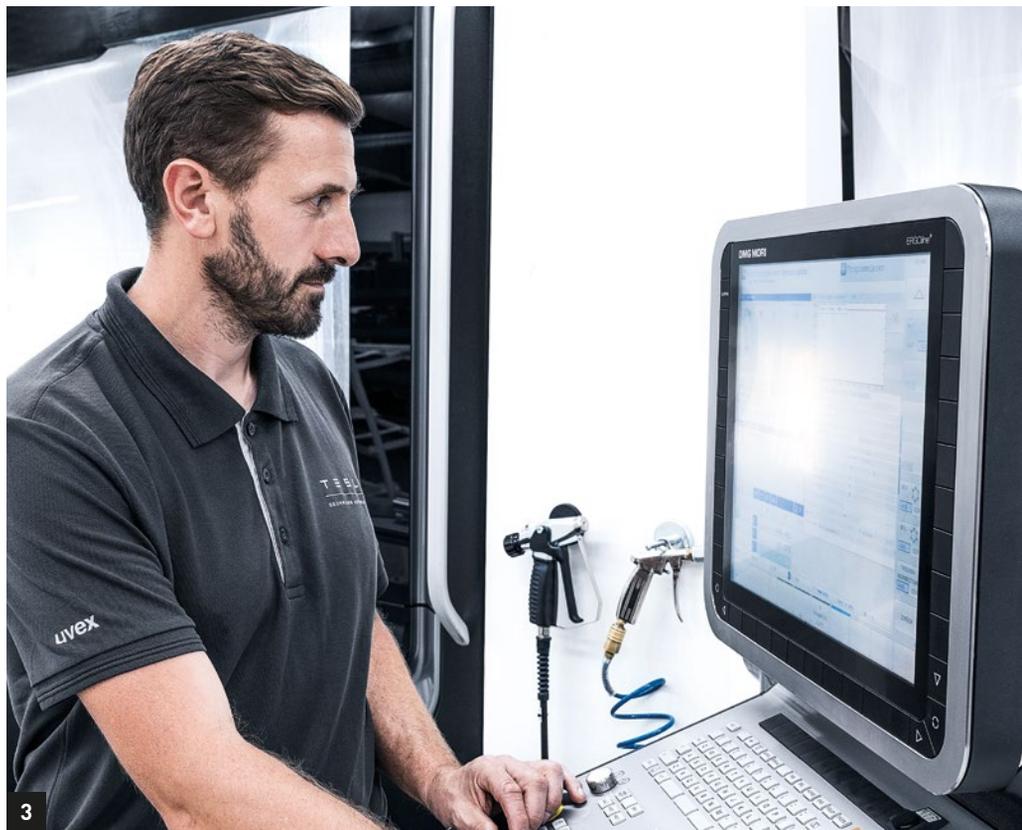


INSURANCE PLUS

- + **100% reimbursement**
- + No excess in the event of a claim
- + **Contribution rates agreed** for 36 months
- + **Reduction in machine downtime** thanks to immediate settlement of claims by DMG MORI
- + **No external expert opinion** necessary
- + **No deduction for wear and tear** (spindles and parts with a lifetime of > 5 years)
- + **Immediate settlement of claims**



1



3

1. Manfred Engeln (left), Production Manager Tesla Grohmann Automation, and Rainer Dittmar, Area Sales Manager DMG MORI.
2. Using the SERVICEcamera during a NETservice test run at Tesla.
3. Marco Gillenkirch, Tesla machine operator at the DMC 1150 V.
4. 95% machine availability is the target at Tesla Grohmann Automation.

Two DMG MORI service engineers were on site every week during this phase. "Two DMC 60s with RS3 pallet changer and a CTX beta 1250 TC were also thoroughly overhauled by DMG MORI Used Machines GmbH."

Following a full appraisal, Tesla Grohmann Automation GmbH together with DMG MORI were in a position to plan concrete maintenance activities. Tesla Grohmann

Automation emphasizes the win-win situation for both parties: "On one hand, this enables us to reduce unplanned service calls to a minimum; on the other, DMG MORI is able to plan its capacity in the service department much more effectively and thus optimize response times." One eye is also continuously kept on spare parts availability, thus guaranteeing that help is quickly at hand if required. The new service strategy has borne fruit.

While this has resulted in machine availability being further increased, DMG MORI has been able to considerably reduce the number of personnel at Tesla Grohmann Automation over time. Today, a service engineer is on site approximately every two weeks to carry out maintenance. Unplanned service visits have become very rare.



2



Always ready to help if you need us:

We are available around the clock in emergencies. Experienced, highly qualified DMG MORI service staff are available for you 24 hours a day, 7-days a week via the 24/7 hotline.



Vitali Halle
Service expert at
DMG MORI Germany



4

NETservice for Industry 4.0

Tesla Grohmann Automation is keen to continue the close cooperation with DMG MORI. "This is of benefit to all those concerned – particularly with regard to the learning processes we are confronted with due to increasing digitalization." With a view to the future topic, Industry 4.0, Tesla Grohmann Automation points to NETservice and other digital offerings from DMG MORI which will further improve service in the future. "We would like to take an active part in this development."

«

**DMG MORI Full Service:
Comprehensive, worry-free package
for new machines**

To keep costs in check, Tesla Grohmann Automation takes out a DMG MORI Full Service contract with each new machine – for the first time in 2016 when purchasing a DMF 360 *linear*. The monthly flat-rate charge includes all repair and travelling costs as well as the costs for spare parts and consumables

such as wipers, filters and brushes. A comprehensive annual service is also part of the package. In addition, DMG MORI Full Service includes machine breakdown insurance with Allianz. This meets 100% of the costs in the event of a crash and saves Tesla Grohmann Automation a considerable amount of time thanks to the immediate approval and settlement of claims.

DMG MORI Full Service covers a period of three years from the purchase of a new machine. As Tesla Grohmann Automation also wanted to ensure machine availability after this period, a special maintenance contract covers them as well as older existing machines. "This also guarantees a 24-hour hotline for rapid assistance and ensures the availability of spare parts."

TESLA FACTS

- + Tesla Grohmann Automation GmbH was founded in Prüm in 2016 after Tesla took over Grohmann Engineering GmbH
- + Around 1,000 employees develop and build complex assembly lines for the Tesla factories
- + The production target for the Model 3 is 5,000 vehicles per week



Tesla Grohmann Automation GmbH
Rudolf-Diesel-Straße 14
54595 Prüm, Germany
www.tesla.com





INTEGRAL PRODUCTION SOLUTIONS WITH OUR SEAL OF QUALITY

CERTIFIED MACHINE PERIPHERALS AND ACCESSORIES

DMG MORI Qualified Products –certified machine peripherals and innovative technology accessories with maximum performance and quality standards.

YOUR BENEFITS

- + **Everything from a single source**
Perfectly matched machine peripherals and innovative technology accessories for every DMG MORI machine
- + **Certified interfaces**
Simple connectivity for all DMQP products via certified standard interfaces
- + **Selected partners**
Our DMQP partners stand for the highest levels of innovation and technology competence and maximum quality standards

PERIPHERALS AND ACCESSORIES IN 4 DMQP CATEGORIES

1	SHAPING	2	HANDLING
	<ul style="list-style-type: none"> + Cooling systems + Oil mist separators + Steady rest + Tool holders + Tools + Rotary tables + Clamping fixtures / chucks + Air filters + Software (CAD/CAM) 		<ul style="list-style-type: none"> + Bar feeders + Automation (robots, work-piece and pallet handling) + Chip conveyors + Grippers
3	MEASURING	4	MONITORING
	<ul style="list-style-type: none"> + Measuring probes + Tool/workpiece measuring systems + Tool presetters 		<ul style="list-style-type: none"> + Transformers + Signal lamps + Cameras



Maximum machine performance and the best possible component quality can only be achieved with perfectly matched and certified technology and peripheral components.

Thomas Lochbihler
Director Engineering and Application,
DECKEL MAHO Pfronten GmbH
thomas.lochbihler@dmgmori.com

The ideal combination of excellent tools and exclusive technology cycles from DMG MORI ensures simple use of complex technologies for everyone.

Dr.-Ing. Edmond Bassett
Head of Technology Development,
GILDEMEISTER Drehmaschinen GmbH
edmond.bassett@dmgmori.com





Up to
30 %
DISCOUNT
on the products
of selected
partners

PUT TOGETHER YOUR ALL-ROUND CAREFREE PACKAGE QUICKLY AND SIMPLY WITH OUR TECHNOLOGY EXPERTS

1. Together with our experts, select the DMQP certificates that match your new machine – with a price saving of up to 30%.
2. Our DMQP certificate partners will work with you to find the ideal combination of machine and technology accessories.



DMQP-CERTIFICATES

YOUR BENEFITS

- + Purchase your DMQP certificates with the machine
- + Up to 30% discount on the product portfolio of selected partners
- + Financing with the new machine
- + Consultation and implementation by experts from our partners



Certificates:
Profit from our all-round carefree packages at preferential prices.

Christoph Grosch
Head of DMQP GILDEMEISTER Beteiligungen GmbH
christoph.grosch@dmgmori.com



DMQP Horn certificates offer DMG MORI customers unique benefits: a diverse range of Horn high-performance tool systems, competent and individual consultation provided by Horn experts and exclusive conditions.

Andreas Vollmer
Head of Sales and Member of the Management Board
Hartmetall-Werkzeugfabrik Paul Horn GmbH

With DMQP certificates, DMG MORI customers benefit from the latest WTO tool holder technology on more exclusive terms with the purchase of a new machine.

Dipl.-Ing. Sascha Tschiggfrei
Managing Director
WTO Werkzeug-Einrichtungen GmbH



NEW: OPTOMET – FIRST TIME RIGHT

SOFTWARE FOR PARAMETER OPTIMIZATION

DMG MORI has developed the software **OPTOMET** in cooperation with INTECH for controlling the parameters of the powder bed process. It has self-adjusting and learning algorithms that calculate all required parameters of the SLM process in advance within minutes. This means layer thicknesses can be calculated freely, which in turn enables a faster and therefore also more productive build. **OPTOMET** has a material database that allows customers to use materials from all manufacturers without having to test them in advance. The open system also allows independent expansion of the database using the customer's own experimental data. **OPTOMET** is able to adjust parameters in such a way that material properties, such as hardness, porosity and elasticity, can be changed or optimized.

CELOS for optimum workflow in pre- and post-processing

The integral software solution for CAM programming and machine control, **CELOS**, rounds off the process chains for the LASERTEC *SLM* series. The coordinated and standardized user interface enables parts to be programmed offline quickly and transferred to the machine – regardless of their complexity. Due to the efficient flow of information and intuitive operation, **CELOS**

ensures an optimum workflow in the pre- and post-processing of additively manufactured parts. As a consequence, the open system of the LASERTEC *SLM* series enables individual adjustment of all machine settings and process parameters, right through to an extensive choice of material suppliers.

LASERTEC 12 *SLM* – four-times more accurate than the industry standard

Precision in additive manufacturing depends basically on three parameters, namely minimizing focus diameter, layer thicknesses and powder particle size. DMG MORI has taken exactly these parameters into consideration in the development of the new LASERTEC 12 *SLM* and has designed a high-precision machine for building the thinnest walls. The top properties and features already familiar from the LASERTEC 30 *SLM* 2nd Generation – the rePLUG powder module, **CELOS** as an integral software solution, the open system and ergonomic design – also apply without exception to the LASERTEC 12 *SLM*, making this innovative machine the ideal addition to the DMG MORI portfolio of process chains in ADDITIVE MANUFACTURING.

DMG MORI developed the LASERTEC 12 *SLM* with a special focus on precision. A small focus diameter of 35 µm over the entire build »



volume enables high-precision creation of the thinnest walls – four-times more accurate than the current industry standard. The thin layers can be built accurately and with exact repeatability thanks to integrated linear scales with a resolution of less than 1 µm. An integrated sieving unit prevents larger particles or agglomerates from entering the build chamber immediately before introduction of the powder. In addition, the application of the powder in the build process is carried out safely in an inert gas atmosphere.

Despite its specialization and optimization in the high-precision building of filigree structures, DMG MORI has nevertheless managed to achieve a build volume of 125 × 125 × 200 mm – the largest in this accuracy class. The ergonomic construction of the machine in Stealth design also reflects the principle that DMG MORI has been pursuing and optimizing continuously for many years, namely making the machine easy to use and efficient by ensuring better accessibility to all key elements. Furthermore, the LASERTEC 12 SLM is based on the same machine platform as the LASERTEC 30 SLM 2nd Generation, making this new development just as robust while retaining compatibility with

OPTOMET

ADAPTATION OF THE POWDER PROPERTIES

Powder Properties (PSD)		
D10	<input type="text" value="12"/>	µm
D50	<input type="text" value="28"/>	µm
D90	<input type="text" value="52"/>	µm
Peak	<input type="text" value="22.36"/>	µm
Mean	<input type="text" value="30.3"/>	µm
Apparent Density	<input type="text" value="4.53"/>	g/cm ³
Flowability	<input type="text" value="1.24"/>	g/sec

- + **Unlimited choice**
of material supplier –
without any R&D effort
- + **No compromise in quality**
Reduced material costs thanks to
the use of recycled powder

both the conventional rePLUG and rePLUG reSEARCH. Rapid material changeover in less than two hours boosts the productivity of the LASERTEC 12 SLM enormously.

DMG MORI has designed the rePLUG reSEARCH especially for the development of materials. In contrast to the conventional rePLUG, this module has bottle-based powder feed suitable for significantly smaller material quantities, instead of the

large powder container with a closed powder circuit. This ensures simple cleaning of the system, which brings great time savings and reduces the risk of cross-contamination to a minimum – especially important when trying a variety of materials. Any excess powder is collected in a bottle and can be sieved externally, ready for reuse.

«

LASERTEC 12 SLM

HIGH- PRECISION SELECTIVE LASER MELTING

- + Four-times more accurate than the current industrial standard:
35 µm focus diameter
- + Largest build area in its accuracy class: **125 × 125 × 200 mm**
- + rePLUG powder module for safe material changeover in less than two hours



SIEMENS
Ingenuity for life

Utilize the potential of Additive Manufacturing with NX and SINUMERIK.

siemens.com/additive-manufacturing

90% TIME-SAVING AND NEW GEOMETRIES THANKS TO SELECTIVE LASER MELTING



The LASERTEC 30 SLM 2nd Generation is the perfect addition to our production facility.

Robin Riedel
Managing Director of
STB-Service Technik Beratung GmbH

STB, founded in 1994 in Strausberg, Brandenburg, is an accomplished manufacturer of special seals for pumps, compactors, fans, compressors and turbines. Customers are to be found, for example, in the oil and gas industry. The product portfolio also includes anti-friction surfaces for floating ring seals. STB supplies customers in Europe as well as in the USA and Asia. The range of services includes the repair and refurbishment of technical equipment. STB has been using machine tools from DMG MORI since 2012, and with the LASERTEC 30 SLM 2nd Generation, the step into additive manufacturing was taken in the fall of 2018.

"We like to support our customers by providing individual solutions," says Robin Riedel, second generation Managing Director of STB, in describing the family company's philosophy. The path to the optimal solution starts in product development. "Here we benefit from our experience in the end user's business and from our expertise in design and production." High performance machine tools

that reliably ensure consistent production quality are the be-all and end-all for STB. "DMG MORI is a byword for pioneering CNC technology and impresses us with its broad product spectrum. In particular, the range for additive manufacturing of metal components is a perfect addition for STB," says Robin Riedel, referring to the LASERTEC 30 SLM 2nd Generation machine installed in the previous fall.

An additively manufactured component replaces several conventionally produced parts

Selective Laser Melting enables STB to additively manufacture highly complex workpieces. "The technology gives us an advantage particularly in the case of new developments, as we do not first have to manufacture a mold for a casting." This only becomes worthwhile for larger quantities. "What is more, the time saving is 90%." In addition, SLM technology has manufacturing potential that goes beyond the possibilities of traditional machining: "Such designs would simply not be possible with this degree of

MATERIAL
CHANGEOVER
<2h



LASERTEC *SLM*

rePLUG – THE POWDER MODULE FOR FAST MATERIAL CHANGEOVER

- + **Automated powder handling**
and powder storage under inert gas atmosphere
- + **One material per rePLUG** – expansion of the material range
due to modular changeover system
- + **Contamination-free changeover** between different materials
in <2 hours
- + **Safe powder handling** thanks to integrated peripherals
and sealed material circulation
- + **Increased efficiency** through integral powder recycling
- + **High process autonomy** thanks to **efficient duo-filter system**
(filter can be changed without interrupting the process)
and **large powder reservoir** (no manual refilling necessary
during the process)

compactness using conventional methods alone”, explains Robin Riedel referring to a stainless steel housing, which requires finishing in only a few places following production in the powder bed. In this way, several conventionally produced parts can be replaced with one additively manufactured component. “The cost advantage for the customer in such cases is enormous.”

NEW MARKET POTENTIAL THANKS TO *SLM* TECHNOLOGY

rePLUG powder module for changing material quickly and safely

There were several reasons for purchasing the LASERTEC 30 *SLM* 2nd Generation, including the long and beneficial business relationship with the supplier. Robin Riedel: “It is an advantage for us to have one point

of contact for all our machines.” The powder bed machine is also impressive from a technological point of view. “Rapid powder changing with the help of the rePLUG exchangeable module is a productive, user-friendly and, above all, safe solution.” No powder can escape thanks to the sealed powder circulation system. Until now, STB has been producing stainless steel workpieces on the LASERTEC 30 *SLM* 2nd Generation. Now, however, the first enquiries for components made from Inconel have started to appear.

Opening up new market potential with SLM technology

With sales offices in Bremen, Shanghai and the USA, STB has grown strongly in recent years. “New technologies such as Selective Laser Melting have assisted this growth,” says Robin Riedel. He sees a great opportunity for further business development in the rapid manufacturing of new developments and the design of completely new geometries: “We are optimistic that we can open up new market potential in this way.”

“On the LASERTEC 30 *SLM* we can now produce geometries that were previously not possible with this degree of compactness – and up to 90% faster.”

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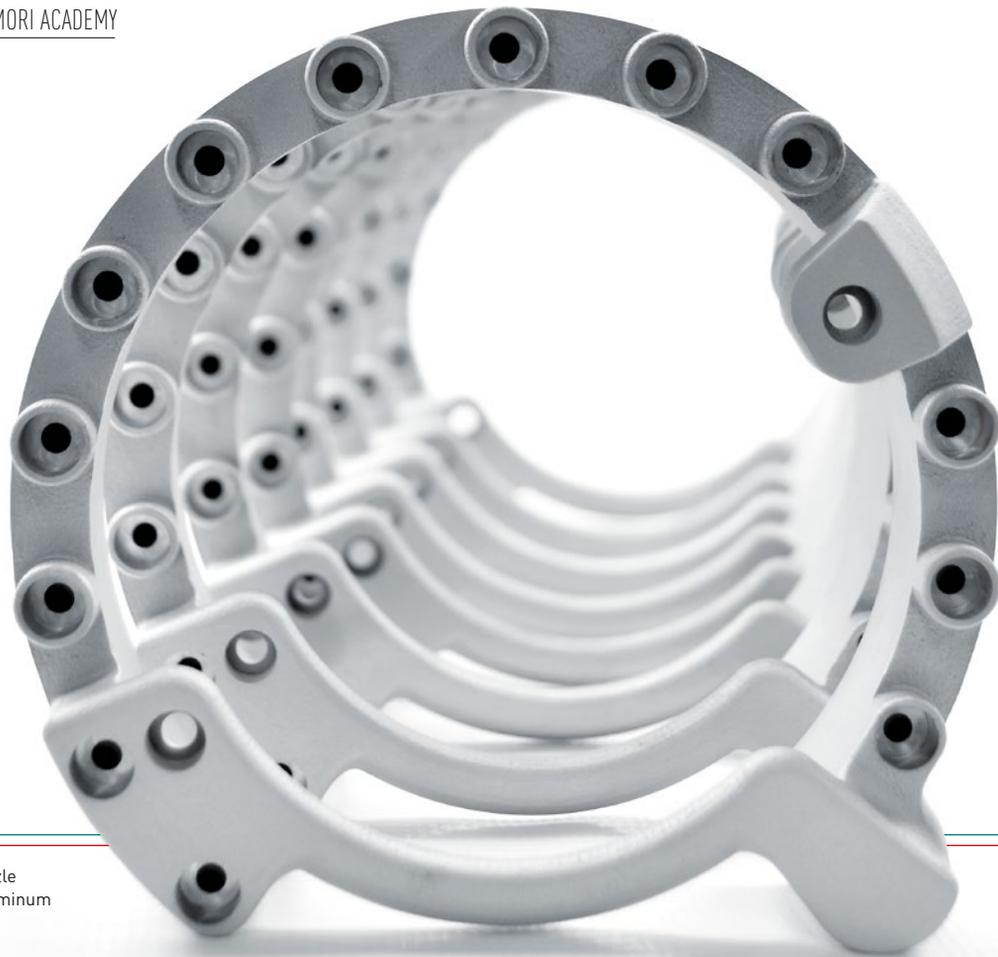
STB FACTS

- + Founded in Strausberg in 1994
- + 72 employees
- + Development and production of special seals (including floating ring seals) for the oil and gas industry



STB-Service Technik Beratung GmbH
Flugplatzstraße 3
15344 Strausberg, Germany
www.stb-dichtungen.de





Coolant nozzle
made of aluminum

DMG MORI ACADEMY

OUR RANGE OF SERVICES

- + AM quick check for the identification of your specific additive manufacturing opportunities
- + Redesign of your components for additive manufacturing
- + Engineering and design of new components and assemblies
- + Simulation and topology optimization
- + Production of prototypes and small series of your components
- + Courses and training for management, design and manufacturing.
- + Consultation from the AM strategy to optimization of your AM production

AM CONSULTING FOR FAST TECHNOLOGY INTRODUCTION

Additive manufacturing is the perfect complement to conventional machining and opens up completely new freedoms in design. The potential of this technology is already recognized in many companies, but often they do not have the necessary knowledge. With its new consulting approach, the DMG MORI Academy pursues the goal of supporting companies in building up the necessary know-how and establishing process chains based on the LASERTEC *3D hybrid* and LASERTEC *SLM* series machines. The consultancy portfolio encompasses services along the entire process chain of additive manufacturing, including the AM Quick Check as the perfect introduction to exploiting the potential.

Starting from the identification of suitable applications, the DMG MORI Academy provides holistic support for additive manufacturing – from engineering the components to production of the first small series. The experts there also offer further advice on the introduction of the technology. They hold training courses to acquaint staff from management, design and production with additive manufacturing. Dr. Rinje Brandis, Head of Consulting Additive Manufacturing at the DMG MORI Academy, sees the key customer benefits as being time savings and the sustainable acquisition of knowledge: “Our team contributes its many years of cross-industry experience in the application of additive manufacturing. Together with our customers, we drastically accelerate their introduction to the technology and help implement it directly in innovative products”.

AM Quick Check:

Entry into additive manufacturing for development and design

Additive manufacturing today offers virtually unlimited potential for innovative solutions. The key to using it successfully is know-how and choosing the right applications. The DMG MORI Academy's Quick Check is the perfect entry into exploiting this potential. Competent DMG MORI engineers help companies in a two-day workshop with the needs-based introduction of the technology in their specific sector. This includes building up the necessary know-how and identifying components with additive manufacturing potential.

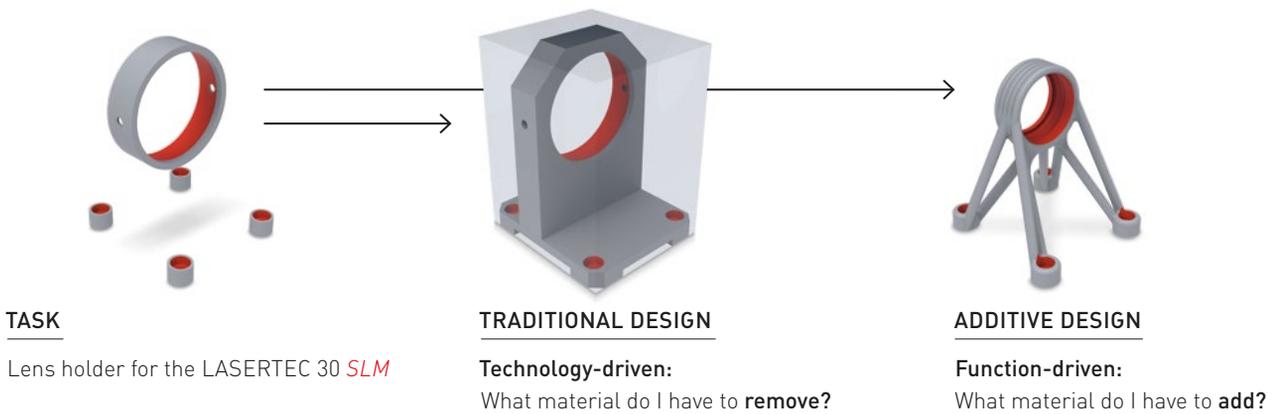
“Together with our customers we analyze their range of products and identify areas of application that are relevant for ADDITIVE MANUFACTURING. The result is a roadmap for further implementation of the technology in specific business cases”, explains Dr. Rinje Brandis, Head of Consulting Additive Manufacturing at the DMG MORI Academy. Such a case has already been carried out successfully within the Group in cooperation with SAUER GmbH. “We developed an annular nozzle together, which was produced by the powder bed method and is now an integral part of the ULTRASONIC technology.”



Dr. Rinje Brandis
 Head of Consulting
 Additive Manufacturing
 DMG MORI Academy
 rinje.brandis@dmgmori.com

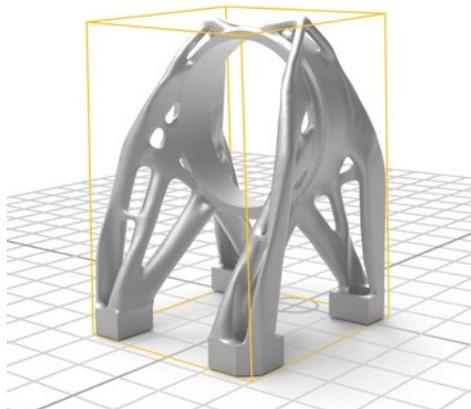
CONSULTATION FOR ADDITIVE MANUFACTURING

ADDITIVE MANUFACTURING ENTAILS RETHINKING THE DESIGN PROCESS



DMG MORI ACADEMY

WITH TOPOLOGY OPTIMIZATION FOR OPTIMUM ADDITIVE MANUFACTURING DESIGN



Lens holder LASERTEC 30 *SLM* 2nd Generation

- + **Cost reduction due to lightweight construction:**
 Reduced material usage due to structure optimization
- + **Design advantages:**
 Freedom in the design process
- + **Unrivaled:**
 Cannot be produced conventionally

SUCCESS IN MOTORSPORTS

THROUGH TECHNOLOGY
COOPERATION WITH DMG MORI





DMG MORI

Official Partner of TOYOTA GAZOO Racing
World Rally Team in FIA World Rally Championship

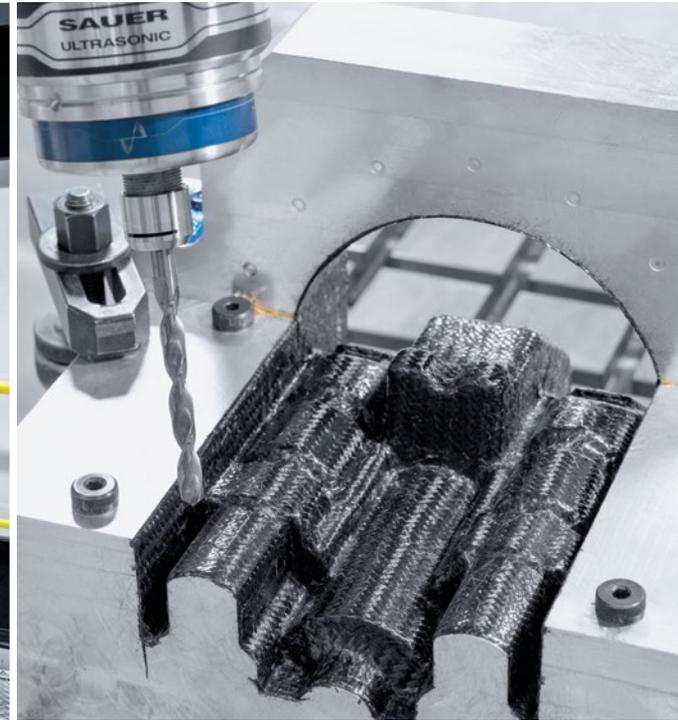
Motorsports has a decade-long tradition at Toyota, which the car manufacturer has successfully continued since 2015 under the name TOYOTA GAZOO Racing. The double victory in the Le Mans 24-hour race last year and the overall victory in the FIA World Endurance Championship (WEC) 2014 underline this commitment, as does the overall victory in the FIA World Rally Championship (WRC). Toyota Motorsport GmbH in Cologne is a key location within the group, where 300 employees develop and construct both the LMP1 vehicle for the WEC and the motor for the new Yaris WRC. DMG MORI supports the demanding production within the

framework of a technology cooperation with innovative machining centers and turning machines – 21 in total. One of the latest purchases is the DMU 200 Gantry with integrated ULTRASONIC spindle, on which Toyota Motorsport machines high-quality composite components in a dry machining process.

Due to its light weight and high strength, carbon fiber is an essential material in the development of racing cars. Machining it, on the other hand, is very time consuming, explains Marcel Voigt, responsible for CNC production and programming at Toyota Motorsport: "For every component, we need tools on which we laminate the carbon fiber before it is baked in an autoclave." Both the production of the tools – which are made of a special plastic, aluminum or also carbon fiber – and the subsequent machining of the complex carbon fiber components are carried out on CNC machining centers. "To prevent the edges from fraying, something that can easily happen with carbon fiber, we mill them with specially ground and coated tools. We were also able to achieve further improvement in the quality of the components with the ULTRASONIC technology." »



Installation of the DMU 200 Gantry in a pit to enable ground level loading and unloading of the delicate carbon fiber components with a forklift.



Process reliability in the machining of composites on the DMU 200 Gantry, thanks to the fully automatically exchangeable ULTRASONIC spindle.



DMU 200 Gantry with an optimum work area concept

In the summer of 2018, Toyota Motorsport installed its first DMU 200 Gantry from DMG MORI configured specifically for this purpose to expand its capacity for dry machining of composite components. Thanks to its low-profile gantry, the 27m² footprint of the machine is extremely compact when one considers its spacious 2,250 x 2,000 mm work area (also available from DMG MORI as an option with 4,000 mm of X-axis travel). "This meant we could integrate it perfectly in the designated part of the plant", recalls Marcel Voigt about the installation. The machine was brought in through the roof of the hall in one piece. "We also set it up in a pit, so we can move the delicate components into the work area with a forklift at ground level instead of having to use a crane." This is also a great advantage where ease of use is concerned: "You can see into the machine clearly from the side at all times."

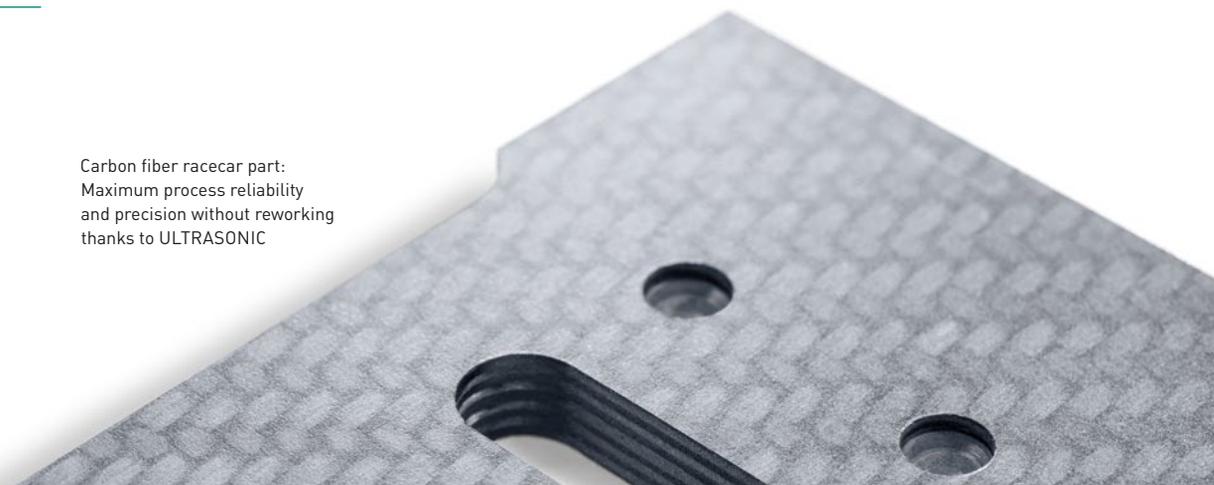
ULTRASONIC technology for machining composites

Designed for the machining of composites, the DMU 200 Gantry is equipped with an ULTRASONIC spindle in which special ULTRASONIC tool holders can be changed fully automatically from the tool magazine. This technology integration enables targeted superimposition of tool rotation with an ULTRASONIC vibration in the axial direction. Amplitudes up to 10µm with a frequency of 20 – 50 kHz can be achieved in this way. The effect results in a reduction in process forces of up to 40%, which depending on what is required of the process can be used to achieve higher feed rates, longer tool service life or improved surface finishes. When machining fiber composites, ULTRASONIC enables clean cutting of the carbon fibers thanks to the increased cutting speed and thus meets the highest demands on productivity and component quality. This is apparent on the clean cut edges that minimize fiber splitting and prevent delamination of the component.

With the DMU 200 Gantry including dust extraction and integrated ULTRASONIC technology we can achieve unique results in composite machining.

Marcel Voigt (right) responsible for CNC production and programming at Toyota Motorsport

Carbon fiber racecar part: Maximum process reliability and precision without reworking thanks to ULTRASONIC





Footprint
27 m²

Attention must be paid to the fine dust when dry machining composites, Marcel Voigt goes on to tell us: "That is why the DMU 200 Gantry machine is equipped with a dust extractor and explosion protection. In addition, the A-axis of the milling head even has integrated dust extraction." After the positive experience with dry machining on the DMU 200 Gantry, DMG MORI organized a workshop on this topic at Toyota Motorsport at the end of November 2018, which was attended by around 70 interested parties.

5-axis machining with 0.5 g for surface finishes up to Ra <0.3 μm

The DMU 200 Gantry also meets high requirements for the production of motorsport components when it comes to conventional milling processes. The A-axis with a swivel range of ±120° is equipped with a

5-AXIS MILLING AND ULTRASONIC MACHINING ON ONE MACHINE

40,000 rpm motor spindle for HSC machining. The thermosymmetrical gantry design provides maximum rigidity and enables dynamic 5-axis machining with up to 5 m/s² acceleration in all axes. Consistent tool overhang in the Z-axis ensures that the milling characteristics remain unchanged over the entire work area. Extensive cooling guarantees a high level of long-term accuracy. "The capabilities of the machine are so extensive that we also use the DMU 200 Gantry for machining aluminum molds when our other machines are working to full capacity", says Marcel Voigt. "Thanks to the high axis acceleration we achieve surface finishes of <0.3 μm. We also benefit from the high maximum table load of 20 t."

»

DMU 200 GANTRY

LARGEST WORK AREA WITH LOWEST SPACE REQUIREMENT

HIGHLIGHTS

- + **Maximum workpiece size** of 4 m³ (3-axis) or 2.2 m³ (5-axis)
- + **Fully enclosed working area with integrated chip removal** and good visibility from the side
- + **High rigidity and dynamic milling** (5 m/s² acceleration in all linear axes) due to portal design
- + **Consistent milling characteristics** throughout the entire work area due to constant tool overhang in the Z-axis
- + **Integration of ULTRASONIC technology** possible in the 90° and 45° head

Technical Data		DMU 200 Gantry
Travel X/Y/Z	mm	2,000 (4,000*)/2,000/1,200
Rapid traverse X/Y/Z	m/min	50
Acceleration X/Y/Z	m/s ²	5
Max. workpiece weight	kg	10,000 (20,000*)

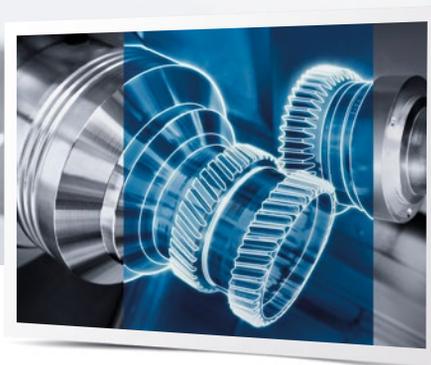
*optional



More information about the DMU 200 Gantry can be found here:
gantry.dmgmori.com



DMG MORI gearSKIVING – Machining of gears on a DMU 60 eVo to grinding quality.



DMG MORI gearSKIVING – gear production in minutes instead of hours

Toyota Motorsport is also breaking new ground in the production of gears for the new Yaris WRC. “We want to have this expertise in-house, instead of ordering gears from a supplier”, Marcel Voigt explains. The company is relying on the gearSKIVING cycle from DMG MORI to achieve the high level of accuracy needed for these gears: “This technology cycle is currently undergoing testing and further development on a

DMU 60 eVo with a mill-turn table and on a CTX beta 1250 TC.” With regard to geometry and surface finish, using this process Toyota Motorsport is aiming to achieve consistent accuracies comparable to those of grinding. “With our small volumes it would not be worthwhile developing grinding as a completely new process, with the machines and personnel that would involve.” Another advantage of the gearSKIVING cycle is speed: “The throughput time per gear is only a few minutes, whereas grinding takes several hours.”

Success in motorsport through technology cooperation with DMG MORI

The technology cooperation between DMG MORI and Toyota Motorsport is at the highest level, as is demanded in the world of motorsport. Marcel Voigt says: “On one hand quality standards are extremely high, because we have to get maximum performance out of the components and, of course, ensure a high level of safety at the same time. On the other hand efficiency plays a vital role, because this is a very fast-moving industry.” This requires partnerships on an equal footing. For many years DMG MORI has been designing pioneering production solutions for demanding sectors – not least for motorsport. Marcel Voigt sees a great opportunity: “If we combine our expertise in the cooperation, we will continue to have success on the racetrack.”

Technology Cycle

DMG MORI gearSKIVING

- + Straight and helical external or internal spur gears and splines
- + Herringbone gear with clearance on turn-mill machines*
- + Crowned gear teeth by mathematical transformation of the 6th virtual axis* on TC machines

* on CTX TC with counter spindle

TOYOTA MOTORSPORT FACTS

- + Toyota Motorsport GmbH (TMG) in Cologne is a 100 % subsidiary of Toyota Motor Corporation (TMC) in Japan
- + Around 300 highly qualified employees at TMG specialize in motorsport as well as research and development projects
- + The 30,000 m² site includes state-of-the-art facilities for design, production, testing and assembly of components and vehicles



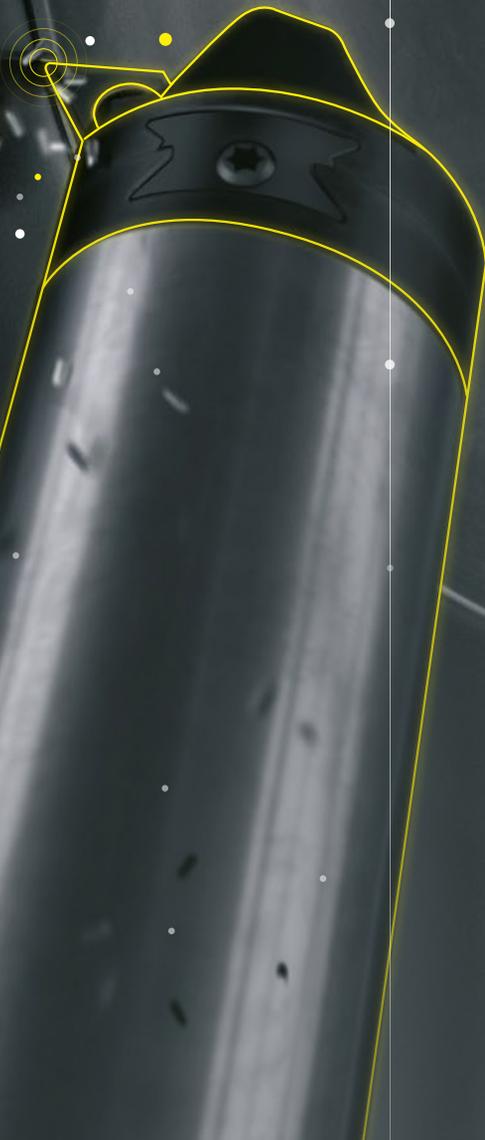
Toyota Motorsport GmbH
 Toyota Allee 7
 50858 Köln, Germany
www.toyota-motorsport.com



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%
O001
[NEW TOOLKIT.18]
[MACHINE = DOOSAN LYNX 300]
[SKRT.P]
[TOOL NUMBER 03 = SILENT TOOL PLUS]
G0 G21 G40 G54 G90 G99
G10 P0 X0 Z0 [CANCEL WORK SHIFT]
G10 L2 #1 X0 Z356.6[G54]
G90 S3600
M01
N3
G0 G18 G40 G80 G99
G54
G28 U0.W0.
M5
[SILENT TOOL PLUS]
T0303
G96 S1200
G96 S300 M3
G00 Y0 Z2.141 M8
X63.756
X73.756
G01 X77.999 Z0.02 F0.25
Z-158.235
G02 X74.078 Z-170.342 R228.525
G03 X72.54 Z-171.665 R2.
G00 X71.481 Z-170.817
X67.481
Z-141
X83.756
G01 X87.999 Z0.02
Z-137.303
G02 X77.999 Z-158.235 R228.525
G03 X76.321 Z-159.515 R2.
G00 X75.261 Z-158.667
X71.261
Z-141
X83.756
G01 X87.999 Z0.02
Z-122.044
G02 X87.999 Z-137.303 R228.525
G03 X86.088 Z-138.498 R2.
G00 X85.028 Z-137.65
X81.028
Z-141
X102.756
G01 X107.999 Z0.02
Z-118.718
X102.979
G02 X99.612 Z-119.881 R1.8
X87.999 Z-122.044 R228.525
G03 X99.924 Z-123.17 R2.
G00 X94.865 Z-122.322
X90.865
Z-141
X113.756
G01 X117.999 Z0.02
Z-21.653
X115.06
G02 X112.141 Z-23.044 R1.461
G01 X111.969 Z-24.826
G03 X10.863 Z-26.21 R2.
G00 X109.603 Z-25.362
X105.603
Z-2.121
G01 X119.295
X123.539 Z0
X118.469 Z-2.534
G02 X118. Z-3.1 R0.8
G01 Z-18.877
G02 X118.445 Z-19.97
G01 X119.556 Z-21.27
G03 X19.6 Z-21.387
G01 Z-21.59 F0.25
G03 X119.474 Z-21.9
G01 X115.06
G02 X111.025 Z-21.229
G01 X110.025 Z-4
G02 X110 Z-45.4
G01 Z-57.935
G02 X110.065 Z-
X111.037 Z-61
G01 X117.167
G03 X117.999
G01 Z-77.276
G03 X115.4
G01 X111.025
G02 X110
G01 Z-118
G03 X109
G01 X10
G03 X10
G00 X6
Z-73.4
G01 Y
X118
Z-77
X118
G03
G01
X
Z

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Alexander Renz
Managing director
of HAIL-TEC GmbH

The LASERTEC 50 Shape Femto is the perfect combination of excellent 5-axis technology and high-tech laser components made in Germany.

RA 0.1 μm

POSSIBLE BY MEANS OF MORE THAN 100 MW IN FEMTOSECONDS

Established in 2004, HAIL-TEC GmbH from the Swabian town of Hohenstein manufactures precision parts for customers in the medical engineering, automotive and other demanding industries. Laser machining systems from DMG MORI have played an important role since 2005. After purchasing three LASERTEC 80 FineCutting systems, HAIL-TEC acquired the LASERTEC 50 Shape with Femto-Laser for ultra-short pulse laser ablation. The company is therefore Germany's first contract manufacturer to have capacity in "cold" laser ablation of ceramics, hard metals, glass and similar materials. HAIL-TEC's policy is to manufacture high-precision stamping dies "Made in Germany" and components with corrosion-free marking (also known as black marking), among other things, within 24 hours.

"At 10^{-15} seconds, a femtosecond is so short that even light travels only $0.3\mu\text{m}$ within that time", explains Alexander Renz, managing director of HAIL-TEC. The femtosecond laser that is integrated into the LASERTEC 50 Shape achieves peak performance of more than 100 megawatts with ultra-short pulses. For comparison: "50 years ago, this was the maximum output of an entire nuclear power station", says Alexander Renz.

Cold laser ablation for reproducible accuracy to within microns

The femtosecond laser in the LASERTEC 50 Shape achieves what laser sources in the picosecond or nanosecond range cannot achieve. The electrons in the workpiece absorb the immense energy of the ultra-short light pulse and transmit it to the atomic cores. The heat is localised with extreme precision, meaning that the material evaporates in a minimal zone – before the surrounding material has even heated up. "In the absence of heat affected zones, the workpiece is not adversely affected by the heat", explains Alexander Renz. This means that there is no slag, spatter, contamination or burrs.

Ra 0.1 μm on the LASERTEC 50 Shape with Femto-Laser

Cold laser ablation with ultra-short pulses enables reproducible accuracy to within microns and surface quality of up to Ra $0.1\mu\text{m}$. Hard metals, ceramics, glass or even chrome-plated plastics can be machined. "With the LASERTEC 50 Shape we undertake many applications that were previously only possible by spark erosion", says Alexander Renz about the new development. This saves time and money in electrode manufacture. "It is also force-free and

tool-less machining, whereby we always achieve the same process accuracy and therefore maximum repeatability on the component."

Simple operation thanks to intelligent software from DMG MORI

The LASERTEC 50 Shape has high-precision zero point clamping, an optical measuring system and a 3D touch-probe that makes setting up simple and straightforward. "Calibration is supported by DMG MORI with technology cycles", adds Alexander Renz. The user-friendly LASERSOFT software developed by SAUER has also been an advantage as far as he is concerned: "Software modules such as the Auto Video set-up make our work much easier". Another highlight of the LASERTEC 50 Shape is the new, high-speed Z-shifter that is installed as standard. It covers larger patches and is significantly more dynamic and accurate, explains Alexander Renz: "We achieve better workpieces in a shorter time in this way". HAIL-TEC can make use of the capabilities of the LASERTEC 50 Shape in a completely different way. Miniaturization in electronics continues to advance. More and more ceramic materials are being used for PCBs. "Wall angles up to 7° are possible when intro-

**WORLD
PREMIERE
2019**

**< 19 m²
FOOTPRINT**



LASERTEC 125 SHAPE

3D LASER TEXTURING OF FREEFORM SURFACES ON WORKPIECES WEIGHING UP TO 2,600 kg, OPTIONALLY WITH TANDEM DRIVE

HIGHLIGHTS

- + Large components up to $\varnothing 1250 \times 700$ mm and 2,600 kg, < 19 m² footprint (without platform)
- + State-of-the-art 100 W fibre laser with switchable pulse length and frequency of 10 – 1,000 kHz
- + **NEW: Fast Scan Mode** for machining at up to 4 m/s
- + **NEW: High-speed Z-shifter** (optional) for machining 3D surfaces at up to 4 m/s (theoretical 30 m/s)
- + Maximum long-term accuracy thanks to monoBLOCK design and smartSCALE measuring systems from MAGNESCALE with resolution of 0.005 μ m in the linear axes
- + Unlimited possibilities in the design of individual structures by means of transition-free “patching” with variable patch sizes
- + Integrated process control by means of 1 control panel with CELOS and integrated LASERSOFT 3D APP

ducing 3D shapes.” Alexander Renz envisages another application in laser labelling with ultra-short laser pulses: “For example, we can mark implants or surgical instruments precisely in deep black that is corrosion resistant”. He thinks that he can further develop his range of services for medical engineering with this so-called black marking.

«

HAIL-TEC GMBH FACTS

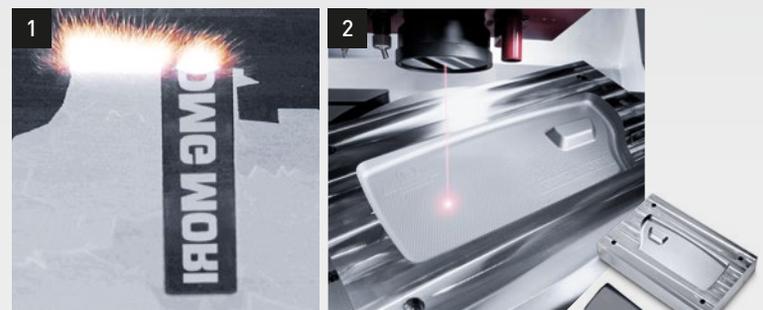
- + Established in 2004 in the Swabian town of Hohenstein
- + 20 employees
- + Germany’s first contract manufacturer to have capacity for “cold” laser ablation



HAIL-TEC GmbH
Gangstetten 2
72531 Hohenstein-Meidelstetten
Germany
www.ukp-laserabtragen.de



The LASERTEC 50 Shape undertakes applications that in many cases were previously only possible by spark erosion.



1. Variable patch sizes for distortion-free machining on the 3D contour 2. 5-axis laser texturing of individual 3D surfaces



Find out more about the
LASERTEC 125 Shape at:
lasertec-shape.dmgmori.com

WORLD
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2019



DMP 70

VERTICAL HIGH-
SPEED MACHINING
CENTER FOR
SERIAL PRODUCTION

- + Workpieces up to **400 kg** in a footprint of **< 4.3 m²**, X/Y/Z = 700 × 420 × 380 mm
- + **5-axis simultaneous machining** with direct drive table, 100 kg maximum load*
- + **10,000 rpm** inline spindle with **78 Nm** in the standard version, optional **24,000 rpm** with 12 Nm or 20 Nm (BT 30, SK 30*)
- + **Ideal for automation**, connection options from the left, right or front
- + **5 μm positioning accuracy** with MAGNESCALE linear encoders
- + Up to **2 g acceleration** for the shortest possible chip-to-chip time of 1.5 sec.
- + **toolSTAR** tool magazine with 15 or 25 pockets*
- + **Process-reliable Design** for production: steep covers in the work area, centrally arranged chip conveyor*, internal doors and central access for maintenance from the back

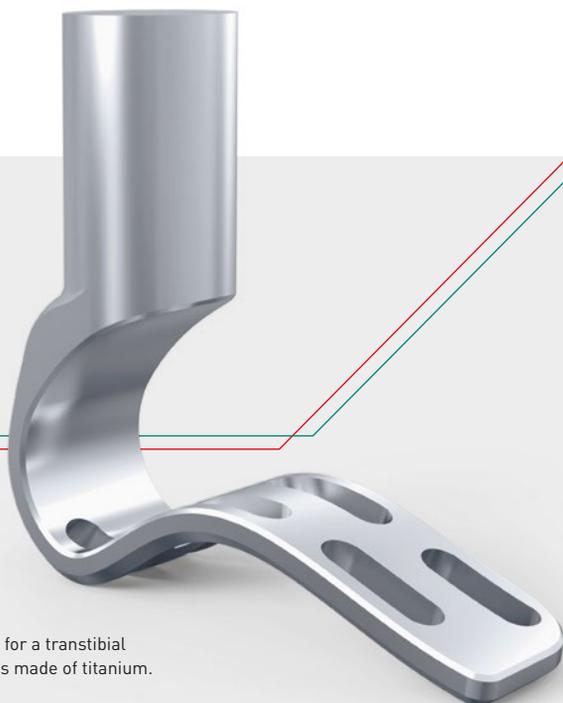
*optional

**DMP 70
with WH 3 CELL
<10.7 m²**

incl. chip conveyor and
integrated 40-bar
internal coolant
supply

WH 3 CELL FOR THE DMP 70

- + Recirculating magazine for **workpieces up to 5.5 kg** (single gripper), **double gripper up to 3 kg**
- + **300 × 200 mm max. workpiece size**
- + **50 or 100 mm max. workpiece height** (carrier-dependent)
- + **8 or 15 workpiece carriers** with 515 × 315 mm effective surface and each with a 20 kg load capacity



Foot core for a transtibial
prosthesis made of titanium.

MEDICAL PACKAGE

- + **Stainless steel covers** in the work area
- + **Inline spindle with 24,000 rpm** and 20 Nm
- + Swiveling rotary table for **5-axis simultaneous machining**, incl. DMG MORI technology cycle 3D quickSET and ATC – Application Tuning Cycle
- + **toolSTAR** tool magazine with **25 pockets**
- + Chip conveyor and space saving **40-bar internal coolant system**
- + Tool measurement and measuring probe
- + **Oil machining package** incl. fire extinguisher system

ORIGINAL SPINDLE SERVICE

REPAIRED BY DMG MORI
WITH A WARRANTY
AT THE FAIREST PRICE



No-one knows the heart of a machine as well as its manufacturer. We repair at the fairest price.

Dr. Christian Hoffart
Managing Director, DMG MORI Spare Parts GmbH

For the best price:
Phone: +49 8171 817 4440, spindle@dmgmori.com

HIGHLIGHTS

- + **Fair Price Guarantees** for spindle service
- + Over **2,000 spindles worldwide, immediately available!**
More than 96% stock availability
- + **New, or exchange spindle service within 24 hours;**
alternatively, inexpensive spindle repair by the manufacturer within a few business days
- + Our spindle experts use manufacturer's know-how to swap or repair your spindle and **only use genuine spare parts**
- + DMG MORI solves your spindle problem quickly and honestly.
Repair by a third party often needs further work!

36-MONTH WARRANTY ON ALL MASTER SPINDLES WITH UNLIMITED SPINDLE HOURS

- + **Technology partnership** is the basis of success
- + **Vacrodur** – the new material for spindle bearings
- + **Effective immediately** for all speedMASTER, powerMASTER, 5X torqueMASTER, compactMASTER and turnMASTER spindles on a new machine

SAVE THE DATE

- + **INTEC Leipzig/Germany:** 02/05/2019 – 02/08/2019
- + **Innovation Days, Chicago/USA:** 05/13/2019 – 05/16/2019
- + **Open House, Bergamo/Italy:** 05/15/2019 – 05/18/2019
- + **Innovation Days, Iga/Japan:** 05/21/2019 – 05/25/2019
- + **METALLOBRABOTKA, Moscow/Russia:** 05/27/2019 – 05/31/2019
- + **50th Anniversary DMG MORI Switzerland:** 06/12/2019 – 06/14/2019
- + **Open House, Bielefeld/Germany:** 06/04/2019 – 06/07/2019



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