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**AGILE . FLEXIBLE
 GLOBAL . TOGETHER**

DMG MORI is maintaining its course of **profitable growth**. We continue to focus on the continual improvement of the quality of our products and services, while at the same time consistently strengthening our **5 future strategic areas**: automation, integrated digitization, ADDITIVE MANUFACTURING, technology excellence and DMG MORI Qualified Products (DMQP).

Where **automation** is concerned, we offer flexible solutions for workpiece and pallet handling. From modular standard systems to customised turnkey projects that are highly integrated, right through to the control. You will find numerous relevant customer reports in this magazine.

We are shaping Industry 4.0 with **integrated digitization**. Core fields include CELOS, new software solutions for production planning, exclusive technology cycles and Powertools. With WERKBLiQ for digital maintenance and the IIoT platform ADAMOS, we also offer an end-to-end digitisation strategy. Our daughter company FAMOT in Poland currently demonstrates how a digital added value chain can be realised in practice. The project is part of a 60 million Euro investment in the expansion of the entire site.

In the field of **ADDITIVE MANUFACTURING**, we will use the autumn trade fairs to present the LASERTEC 30 *SLM* 2nd Generation for increased process autonomy and perfection starting from the first workpiece.

We will also concentrate our **technology excellence** in the key industries "Aerospace", "Automotive", "Die & Mould" and "Medical".

With our partner program **DMG MORI Qualified Products (DMQP)** we offer you, our customers, perfectly aligned peripheral products from a single source.

We are ever present for our customers worldwide. Continued corporate integration means we are well poised to become the "Global One Company". Agile, flexible, global and together with our customers, suppliers and partners.

Dr. Ing. Masahiko Mori
 President
 DMG MORI COMPANY LIMITED

Christian Thönes
 Chairman
 DMG MORI AKTIENGESELLSCHAFT

FAMOT DIGITAL

CONTINUOUS DIGITALIZATION OF THE VALUE CREATION CHAIN



IoT
CONNECTOR

DIGITAL MAINTENANCE
WITH
WERKBLiQ

PRODUCTION
PLANNING

PRODUCTION
FEEDBACK

INTEGRATED
DIGITIZATION

DMG MORI is supporting its customers with their digitalisation operations by providing end-to-end solutions. DMG MORI is currently evaluating and developing how a transformation such as this can be implemented in specific terms at the plant of its subsidiary, FAMOT Pleszew Sp. z o.o. in Poland. As a model project of the future, this is where the entire value creation chain is currently being continuously digitalised

with modular products and services from ISTOS, DMG MORI Software Solutions and WERKBLiQ. The end result will be unveiled before an expert audience during the grand opening on 8th October.

Founded in 1877, FAMOT Pleszew Sp. z o.o., which employs around 700 staff, is one of DMG MORI's most traditional sites. With a total area of 50,000 m², which includes

21,000 m² of production and assembly space, FAMOT is one of the biggest production plants. And it will be the first DMG MORI production plant where everything will be continuously digital over all value creation levels. The remodelled FAMOT plant is therefore marking a milestone for the corporate group as a whole – setting an example for DMG MORI's customers and suppliers.

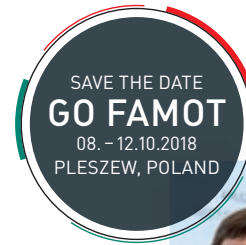
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PRODUCTION COCKPIT





By 2020, the capacity at FAMOT should be increased to more than 2,000 turning and milling machines in the CLX, CMX V and CMX U series – plus a further 2,000 machine frames.



The employees are crucial for the success of the digitisation.

Dr. Michael Budt (right), FAMOT's CSO
 michael.budt@dmgmori.com
Zbigniew Nadstawski, FAMOT's CTO
 zbigniew.nadstawski@dmgmori.com

A flexible mix of internal production and contract manufacturing

In addition to the turning and milling machines of the CLX, CMX V and CMX U series developed and produced at the site and the automation solutions the company develops itself, metal cutting is one of the fundamental pillars of its success. "Beyond meeting our own needs, our production facilities in Pleszew also act as a metal cutting service provider for the DMG MORI production network," explains Dr Michael Budt, the Managing Director.

50 MACHINES IN NETWORKED PRODUCTION

Doubling capacity by 2020

Around 50 networked machine tools, the majority from the group's own "DMG MORI family", are in operation around the clock at the moment in order to meet the enormous demand. Over 1,200 prefabricated machine frames and hundreds of sub-assemblies and components currently leave the plant on their way to the sister companies DECKEL MAHO Pfronten, DECKEL MAHO Seebach, GILDEMEISTER Drehmaschinen in Bielefeld and other group locations.

And demand is on the rise. By 2020 the capacity of the FAMOT plant will be virtually doubled to 2,000 DMG machine tools and around an additional 2,000 prefabricated machine frames. To achieve this, DMG MORI will invest approx. 60 million Euros in the renovation and expansion of the site in Poland by the end of 2018. Another 20 million Euros have been budgeted for future automation projects.

The age of digitization

A considerable part of the future FAMOT project is the digitisation of the entire added value chain. "What belongs together we put together digitally", stresses the General Managing Director Zbigniew Nadstawski. He refers here in particular to the connection to the IT infrastructure of DMG MORI. All added value levels including internal workflows, systems and [automated and manual] process steps had to be seamlessly networked at the same time: From order receipt in sales through to maintenance management, and from integral production planning through to the in-house MDC/PDA software for monitoring key parameters.

"And above all we had to make our personnel digitally fit," stresses Zbigniew Nadstawski. The management sees people as essential for concluding such a mammoth task successfully. They are convinced: "Our employees are crucial for the success of the digitisation."

Declared goals include fast, efficient and secure production processes and an overall sustainable increase in productivity, quality, transparency and response capacity. The specifications also encompassed the requirement for linking existing stand-alone solutions and new software systems into a coherent agile production network.

Digital planning solutions from ISTOS

On its way to achieving these goals, FAMOT relies on the competence of its digital sister companies within the Group. These include DMG MORI Software Solutions (in particular with its **CELOS** portfolio) and **WERKBLIQ** (with its web-based maintenance and service platform). **ISTOS** GmbH with its modular applications for **end-to-end production planning** is of special importance as well.

All parts of the system (such as order management, capture of shop floor data and overall data management) operate autonomously on the one hand, but are all linked via the so-called **SERVICE BUS** on the other. This takes on the role of an intermediary via which all connected applications are on a uniform data set and communicate bidirectionally.



Restructuring production at the touch of a button

"The resulting transparency and efficiency across the entire value creation chain is impressive," says Mr Nadstawski, full of praise. Status messages for an order, he adds, are available at any time and at the touch of a button, right down to the machine or to the assembly station.

With regard to this specific scenario, he provides the following description: "If, for example, there is a risk of an important delivery deadline being missed, or if a time-critical component delivery is delayed, information to this effect is displayed in the **PRODUCTION COCKPIT** in real time. We can immediately run through various planning options, taking

The connectivity of all machines, systems and work procedures was partially already solved internally or will be ensured by the new IoTconnector.

into account the restricted capacity and different priorities, in the **PRODUCTION PLANNING** module. The best alternative solution can then be triggered almost at the touch of a button across the entire process chain."

"The connectivity of all machines, systems and processes that is necessary for this had already been established internally to

some degree, or it was ensured by the new **IoTconnector**," adds Dr Budt, describing a key criterion: "The existing installations are already integrated into the network over the existing MDA / PDA. The CELOS IoTconnector is used where possible and necessary."

In addition to data exchange, the interface offers **NETservice 4.0**, the **SERVICEcamera** for visual support during a remote service call, and the **CELOS MESSENGER** as a fundamental introduction to monitoring and statistical evaluation of the machine condition. Manual workstations are also integrated into the data and planning cycle over what are, in some cases, mobile terminals.

«

OPTIMISES PLANNING FOR THE ENTIRE PRODUCTION – WITHOUT EXCEL

ISTOS



Christian Methe
Managing Director
ISTOS GmbH
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ISTOS GmbH, a DMG MORI daughter, offers customers **simple entry to the optimisation of their production planning** with its app **PLANNING SOLUTIONS**. The challenge here is always limited resources. A good plan takes into account the **capacities of different machines, employees with diverse skills, available materials as well as deliveries from suppliers and customers – all optimised according to setup and throughput times and the cost of capital**. And also not to be left out of the equation: delivery dates that must always be adhered to. Simple tools, such as Excel, often cannot handle such sophisticated planning.

As part of **PLANNING SOLUTIONS**, the **PRODUCTION PLANNING** app breaks down this complexity in a way that enables the user to simply **move orders using drag-and-drop while the recalculation of all production**

processes in the company according to the previously defined optimisation goals remains in the background.

PLANNING SOLUTIONS consists of the apps **PRODUCTION PLANNING, PRODUCTION FEEDBACK** and **PRODUCTION COCKPIT**. Because planning, direct feedback from the workstation and transparency throughout the factory are **decisive for efficiency and flexibility in day-to-day production**. Simple handling is an outstanding feature of the products, which can always be used with multiple manufacturers and applications.

In addition companies also benefit from the **open technologies and modular design** of the solution, which enable them to **integrate existing systems as required** and to **ensure communication between the shop floor and the office floor**. For many customers this is

the first decisive step towards **end-to-end connectivity of their systems** and thus on their path to Industry 4.0.

About ISTOS: ISTOS GmbH stands for "**Innovative Software Technologies for Open Solutions**". The company develops applications for the mid-market manufacturing industry. Its aim is the **cross-machine connection of all production steps along today's supplier and value chain** and the provision of data-intensive applications in the value-adding network of the future.

CELOS

MONITORING FOR THE INTEGRAL AND SUSTAINABLE OPTIMISATION OF PROCESSES



*Dr. Holger Rudzio
Managing Director of
DMG MORI Software Solutions
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More about digital monitoring and CELOS at:
celos.dmgmori.com

“Digital monitoring is an ideal entry into digital transformation!” Dr. Holger Rudzio, Managing Director of DMG MORI Software Solutions, is convinced that digital transparency increases planning security as well as boosting the productivity of companies. The CELOS apps MESSENGER, CONDITION ANALYZER and PERFORMANCE MONITOR, for example, enable the integral digital analysis of the production process and in so doing pave the way towards new future-oriented fields such as predictive maintenance.

CELOS MESSENGER visualises the actual job status of the machines on the shop floor and can display machine-relevant information such as operating status, the current NC program or workpiece counter on mobile terminal devices.

This makes it possible to reduce downtimes and boost productivity as well as evaluate the profitability of jobs based on information such as machine run times, downtimes and failures. **CELOS CONDITION ANALYZER** simul-

taneously uses sensor data to visualise the component-based status of the machine. This information can be used to support preventative maintenance, for example.

CELOS PERFORMANCE MONITOR allows the capture, analysis and visualisation of the effectiveness of the entire system taking machine availability and part quality into account. All of this is good to know, says Dr. Rudzio, but the far greater value derives from having the entirety of the information at your disposal. It means you can evaluate the ramp-up curve of new machines, for example, or quantify the benefit you can expect from complementary digital products (like DMG MORI CAM system). Whatever the case, information is transformed into knowledge and knowledge in turn enables the integral and sustainable optimisation of processes.



**CELOS
MESSENGER**

- Reduce downtimes and boost productivity
- + Live status of networked machines
- + Evaluation of machine run time, downtime and failure
- + Changes in machine status via mail or text message



**CELOS
CONDITION ANALYZER**

- Capture and analysis of machine data and process signals with real-time feedback
- + Capture, storage, analysis and visualisation of machine sensor data
- + Site-independent analysis of one or more machines e.g. for early detection of machine problems
- + Ideal complement to the DMG MORI Industry 4.0 sensor package



**CELOS
PERFORMANCE MONITOR**

- Site-independent capture, analysis and visualisation of machine availability and effectiveness by means of direct feedback from production
- + Measurement of key performance indicators (such as OEE)
- + Job-based performance analysis
- + Available for machines, PCs, tablets & smartphones

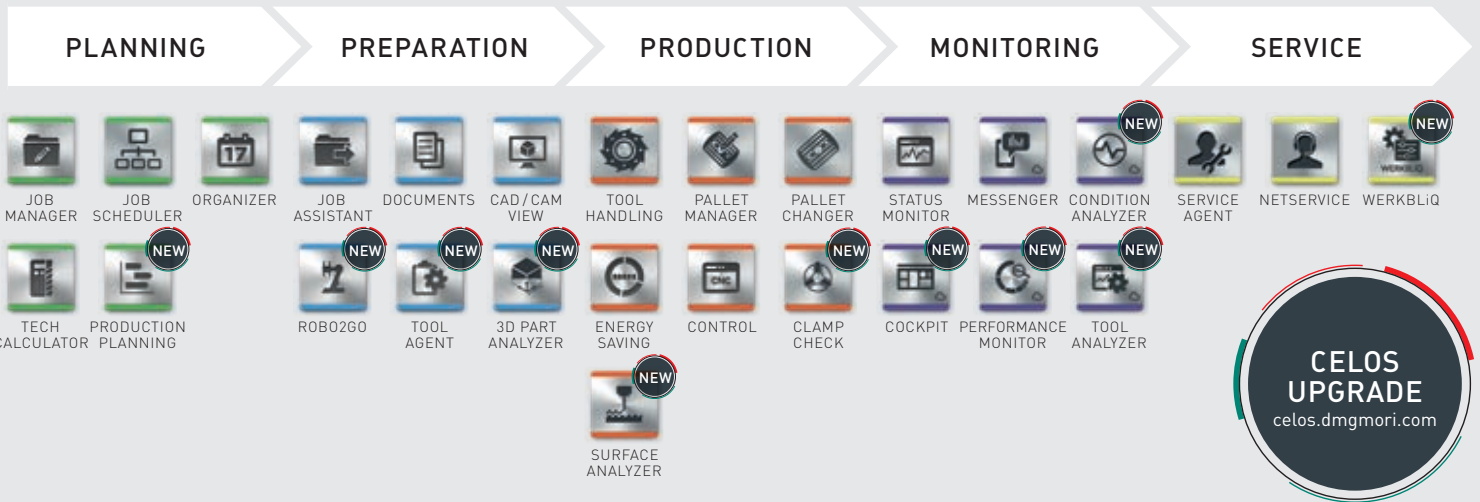
INTEGRATED DIGITIZATION

End-to-end digitisation from planning and job preparation to production and on to monitoring and service.

DMG MORI is the pioneer of digitisation in machine tool building. Under the slogan Integrated Digitization, the technology

leader offers a gradual entry into networked production with CELOS version 5. 27 CELOS Apps offer numerous ultra-modern and intuitive solutions for more efficiency along the entire value chain. This "digital toolbox" offers smaller companies simple and appropriate entry into digitisation and

larger companies modular solutions. All installed CELOS machines can be given a CELOS upgrade by a DMG MORI service technician. With this offer, DMG MORI pursues an integral digitisation strategy for the entire manufacturing sector.



HAIMER 4.0

Connected to the future

Tooling
Technology

Shrinking
Technology

Balancing
Technology

Measuring and
Presetting Technology

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SERVICEcamera
including 5G WiFi transmission, splash protection, lighting, laser pointer and data storage



SIMPLE UPGRADE



THE NEW DMG MORI NETSERVICE QUICK, SECURE AND INTUITIVE

EVERYTHING IN ONE PACKAGE

SERVICE- & MONITORING PACKAGE

- + **NETservice:**
The new remote service for DMG MORI machines
- + **Messenger on ADAMOS:**
All the machines at a glance
- + **IoTconnector:**
Preconfigured for your machine

We found out why the new remote service ensures quick, secure and intuitive support in an interview with Thomas Wolf (COO Service).

“Remote service” as a topic has been followed for a long time in DMG MORI Service. What hopes do you have for NETservice, the brand new successor?

We have had a simple form of the remote service solution in our range for a long time now. But with the introduction of the new NETservice, we are setting a new benchmark that is simply incomparable with the previous tool. We will be able to identify, or even solve, the problems of our customer far more often over the phone, which in turn will allow improved planning of service capacity. Both sides benefit from this.

That sounds interesting. How does the new NETservice differ from its predecessor?

The new NETservice permits **in-depth access to CELOS, IPC and NC**, which in itself promises a higher resolution rate over the DMG MORI hotline. Also, the new **multi-user conference** can be used to add more DMG MORI experts to the session so the problem can be solved quickly together. But the highlight is the **plug-and-play connection of the SERVICEcamera**, which DMG MORI developed itself. Visual support due to **live streaming from the machine straight to the DMG MORI hotline** allows for significant time savings during the problem-solving process.



IoTconnector retrofit kit

including magnetic holder, USB port and Ethernet connection



Thinking of the keyword “security”, there are always concerns when it comes to this topic, aren’t there?

The new NETservice is based on a certified security architecture which guarantees a maximally encrypted connection via a VPN tunnel. The integrated firewall and the IoTconnector’s virus scanner are additional features. The new SERVICEcamera is naturally already seamlessly embedded into this security architecture.

What’s the next step for DMG MORI at this point?

We are keen to exploit the diverse possibilities of NETservice by providing user support, online training with a visual component and also, in the near future, software upgrades or installation of new CELOS apps. We are working tirelessly to achieve this.

«

Practical **retrofitting** of the IoTconnector including magnetic holder, USB port and Ethernet connection.



Thomas Wolf, COO, DMG MORI Service
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But, conversely, the service expert on the hotline can provide helpful documents such as wiring diagrams or instructions directly within the NETservice session.

How does the customer benefit from the new NETservice?

The NETservice is already pre-installed on every IoTconnector and will therefore be an **integral part of DMG MORI machines delivered from now on**. What’s more, the IoTconnector and therefore the NETservice can be retrofitted with extreme ease with the **DMG MORI Monitoring and Service Package**. Put in simple terms, the IoTconnector is a gateway, which connects CELOS and CNC to the Internet via a secure architecture.

DMG MORI NETSERVICE: WHAT’S NEW FOR OUR CUSTOMERS?

- + **Shorter waiting times** due to routing calls directly to the next free service expert
- + **Higher resolution rate** due to extensive access to CELOS, IPC and NC
- + **Maximum data security** due to a certified security architecture (VPN tunnel, virus scanner, firewall)
- + **Live-stream visual support** with an optional **SERVICEcamera**
- + **Swifter solutions** by adding other DMG MORI experts to the session
- + **More intuitive operation compared to previous remote tools**
- + **Direct transfer** of documents and updates
- + **Retrofit kit** for existing machines



You will find everything you need to know about the new NETservice at netservice.dmgmori.com

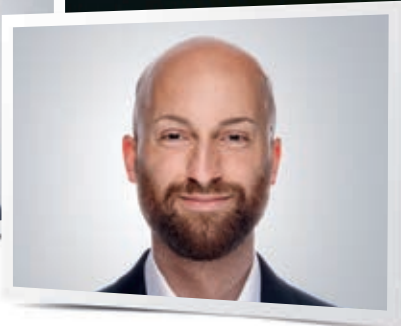
WERKBLiQ

SECURE - PAPERLESS - AUTONOMOUS

THE NEW INTELLIGENCE FOR MACHINE MAINTENANCE.



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MACHINE OPERATORS

- Manufacturer-independent maintenance solution
- Digital cost and service reports



SERVICE PARTNERS

- Simple planning and scheduling
- Increase in customer satisfaction



MANUFACTURER

- Simple & direct communication
- Accelerated data exchange



WERKBLiQ DIGITAL MAINTENANCE

Meeting the challenge presented by digital transformation proves extremely difficult for many companies in the industrial sector. WERKBLiQ shows how simple entry can be achieved despite all the difficulties via the key topic of maintenance. The focus on the manufacturer-independent platform is not only on machines, but also on employees.

Fierce competition and the dynamic development of the market exert great pressure on companies. All the more important it is to ensure high technical availability of production resources. Production managers are confronted with the challenge of reducing machine downtimes to a minimum while at the same time saving time and costs.

Save time and increase quality

Documentation in analog logbooks, maintaining Excel files and leafing through files all takes up a lot of time. With the digital WERKBLiQ logbook operators receive a customised, user-friendly input mask as an interactive man-machine interface. Incidents and all activities connected with the machine are documented with just a click. So opera-

tors not only collect errors, but their causes and solutions as well. The result is a specific knowledge database. Information concerning certifications and audits is also available at all time at just the press of a button.

End-to-end documentation of maintenance and certification processes with WERKBLiQ.

Fabian Haase
Senior Partner Manager, WERKBLiQ GmbH

Minimise machine downtimes

The WERKBLiQ maintenance calendar reminds employees automatically when maintenance is due and ensures that not even the smallest task is forgotten – so even new colleagues can work productively from day 1 onwards. The operator decides when mainte-

nance work is to take place, whether according to manufacturer specifications or based on practical experience. Customers minimise the failure rate of machines by up to 55 % through regular maintenance while at the same time ensuring compliance with ISO 9001: 2015.




You can reduce machine downtimes by up to 55 % with WERKBLiQ

Gerrit Schermeier
Partner Manager, WERKBLiQ GmbH

Save costs

You have to know the maintenance costs in a company before you can reduce them. WERKBLiQ offers the option of capturing the time and materials needed for every maintenance and every repair including costs. Operators will find clear analyses of all relevant key figures in the WERKBLiQ dashboards. The breakdown of the individual machines means customers

INSTALLED WITHIN 48 HOURS

0 – 24 HOURS	24 – 48 HOURS	READY TO GO
		
<p>The first joint steps</p> <ul style="list-style-type: none"> + We introduce you to WERKBLiQ + You name a department, 5 machines and 5 operators 	<p>Account setup & training</p> <ul style="list-style-type: none"> + Creation of your personal account + Receipt of the necessary access data + Training via tutorials or on-site visit 	<p>Simply start</p> <ul style="list-style-type: none"> + Integration into day-to-day work + Other images of your processes + Support from the customer hotline

know the exact amount of the maintenance costs. With WERKBLiQ you can find the right levers for ensuring sustainable cost reduction.

Amortisation of licence fees < 1 year.

Dr. Tim Busse
Manager Director, WERKBLiQ GmbH

WERKBLiQ network

With the open WERKBLiQ platform all those involved in the maintenance process remain networked. Access to the specific service partner and distributor pool enables operators to find new business partners, compare offers and save costs.

Maintenance, Service, Purchasing and Procurement all benefit from WERKBLiQ.

Gerrit Schermeier
Partner Manager, WERKBLiQ GmbH

Acceleration of response times

In the event of a machine breakdown, WERKBLiQ can be used to send a repair order directly to internal maintenance. In this way maintenance staff only receive enquiries via a single channel. All relevant information such as machine type, department, contact person, description of the fault and photos are sent directly from the machine and leave no question unanswered.

Up to 75% increase in the efficiency of service technicians.

Fabian Haase
Senior Partner Manager, WERKBLiQ GmbH

WERKBLiQ

YOUR BENEFITS

HIGHLIGHTS

- + Secure and seamless documentation – always prepared for audits
- + Fast assignment of technicians directly from the machine
- + Minimisation of downtimes through observation of maintenance intervals
- + Fast procurement of spare parts
- + Simple, cross-departmental communication





Dr.-Ing. Edmond Bassett
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Customers replace up to three stand-alone machines with a turn & mill centre thanks to the new crownHOBGING cycle.

OVER 10,000 CYCLES A YEAR

Exclusive DMG MORI technology cycles are effective assistants for shop floor programming and the simplest way to boost productivity, enhance safety and expand machine capability. They offer a clear program structure, intuitive operation and enable up to 60% faster programming. In addition, they help minimise errors as well as allowing the internal transfer of complex technology know-how.

Outstanding customer benefits mean **DMG MORI's exclusive technology cycles** have been writing their own digital success story for years. Their record in the field of integrated technologies is especially impressive: users trust in the exclusive technology cycles on more than **95% of all turn & mill universal turning** centres in the CTX TC series.

"Far more important for us, however, is the **added value for and appreciation from our customers**", stresses Dr. Edmond Bassett as Head of Technology Management at GILDEMEISTER Drehmaschinen GmbH. He takes the **MPC technology cycle**, a version **sold over 100 times a month** and thus one of the most successful technology cycles, to illustrate the high degree of acceptance among customers. MPC stands for Machine Protection Control which, thanks to its inte-

grated acceleration sensor, increases process safety, enables spindle bearing diagnostics and prevents expensive damage caused by collisions.

60% FASTER THANKS TO CONVERSATIONAL PROGRAMMING

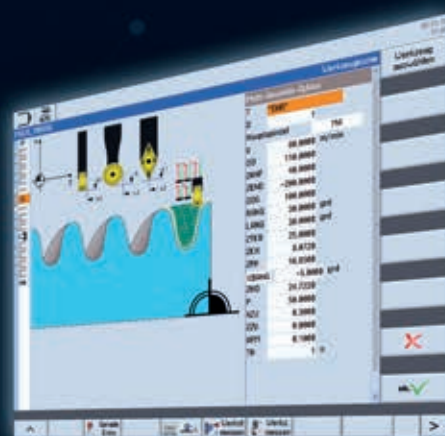
"Complex production processes that were reserved for special machines in the past now count among our powerful drivers of innovation", says Dr. Edmond Bassett as Head of Technology Management at GILDEMEISTER Drehmaschinen GmbH.

"Intensified technology integration adds a whole new dimension to the term complete machining" he stresses. DMG MORI gearSKIVING is just such an example. This enables the production of top quality gears through the input of clearly structured programs.

The exclusive portfolio currently includes 30 DMG MORI technology cycles, with two more to follow in time for the AMB. Dr. Bassett

refers expressly to the new "crownHOBGING" cycle for the production of demanding Hirth couplings: "This enables users of our turn & mill centres to generate the programs they need virtually at the press of a button. The cycle handles the required tooth path calculations and the settings for the axis movements", he concludes.

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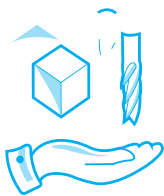


DMG MORI technology cycles – 60% faster thanks to conversational programming.

5-AXIS SIMULTANEOUS MACHINING ON TURN & MILL TURNING CENTRES

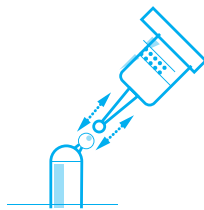
- + High surface quality and smooth transitions in combination with thermal compensation
- + Free form surfaces with 5-axis interpolation at the main- and counter-spindle
- + Turning and milling with an interpolating B-axis
- + With ATC turning for enhanced machine dynamics
- + Look-ahead function for continuous machining

HANDLING CYCLES



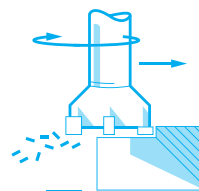
- + Simplify machine operation – e.g. B-axis plunging
- + Automate processes – e.g. counter-spindle centre
- + Reduce operator errors with increased safety – e.g. turret-mounted steady rest

MEASURING CYCLES



- + Increase machining accuracy – e.g. 3D quickSET
- + Open up new measuring possibilities for bulky component geometries – e.g. L-measuring probe
- + Increase transparency in QA processes – e.g. gearMILL with in-process measurement

MACHINING CYCLES



- + Integrate new machining processes – e.g. gearSKIVING
- + Expand machine capability – e.g. grinding
- + Simplify complex programming tasks – e.g. Multi-threading 2.0

MONITORING CYCLES



- + Boost machine safety – e.g. MPC – Machine Protection Control
- + Increase process reliability – e.g. Easy Tool Monitoring 2.0
- + Adapt processes to eliminate vibrations – e.g. MVC – Machine Vibration Control



WH 15 CELL: Modular automation system for workpieces up to 15 kg.



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Markus Rehm
Managing Director of
DECKEL MAHO SEEBACH GmbH
and DMG MORI HEITEC GmbH
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PARTNERS FOR INTEGRATED AUTO- MATION SOLUTIONS

Automation is a key pillar of the DMG MORI strategy for the future. One in every four new machines is already automated or ready for automation. DMG MORI strengthened its automation expertise in November 2017 by starting a joint venture with HEITEC AG. We spoke with the two managing directors of the new DMG MORI HEITEC GmbH in Erlangen, Markus Rehm and Kai Lenfert, about the start-up phase and the company's future ambitions, requirements and goals.

Digitisation has been the hot topic over the last few months, with automation technologies also reporting record figures.

Do you see a direct connection here?

In addition to information and production technologies, process automation and digitisation are two sides of the same coin. As a cross-sectoral topic, automation has therefore taken on a fundamentally key role. This applies to complexity and cost effectiveness of production and it is also growing in relevance due to the increasing shortage of skilled labor.

What role does DMG MORI HEITEC play in these interlinked requirements?

DMG MORI HEITEC GmbH acts as the automation partner for the DMG MORI production plants. The interplay of the engineering competence at the plants and DMG MORI HEITEC's automation expertise means that customers receive an integral and reliable solution: from engineering, tooling and NC programs right through to integrated automation, all from a single source.

Why this focus on workpiece handling?

On the one hand, DMG MORI already has solutions for pallet handling, as do other established partner companies. On the other, in the field of robotic automation, we will in future also be offering solutions for combined workpiece and pallet handling.

What principal arguments will DMG MORI HEITEC use to establish itself on the market?

The digital twin is the virtual image of the entire kinematic machine and a real-time automation model. The actual motion sequences can be viewed, from acceleration

through to braking. This makes it possible to commission the entire automation system virtually in advance, reducing installation time on site by 80 percent, as was described in the Leistritz reference project.

How do you see future developments?

This new holistic view of the process will certainly constitute a greater challenge for us as a supplier. In future, production processes at the customer and automation will form one entity. We see this development above all as our chance to further differentiate our company by offering complementary (digital) services.

DMG MORI HEITEC FACTS

- + Robotic workpiece handling for SMEs
- + End-to-end process concept: engineering, fixtures, tooling, NC programs and automation from a single source
- + Digital twin – virtual image of the entire kinematic machine and automation model in real-time: 80% shorter commissioning time on site thanks to completely implemented processes

DMG MORI HEITEC

DMG MORI HEITEC GmbH
Güterbahnhofstraße 5
91052 Erlangen, Germany
www.dmgmori-heitec.com



Everything from a single source: We are now able to offer our customers a reliable turnkey solution – from engineering to fixtures, tooling, NC programs and on through to integrated automation.

Markus Rehm
Managing Director of
DMG MORI HEITEC GmbH



DMU 50 WITH WH 15 CELL

END-TO-END – PROCESS, MACHINE AND AUTOMATION FROM A SINGLE SOURCE

HIGHLIGHTS

- + Automated workpiece handling for components up to 15 kg
- + Perfect integration of milling machine and automation thanks to end-to-end process concept and digital twin
- + speedMASTER 20,000 rpm spindle with 36-month warranty
- + Swivelling rotary table for 5-axis simultaneous machining with wide swivel range of -35 to +110 °
- + 42 m/min rapid traverse
- + Tool magazine with up to 120 pockets
- + Also for the CMX V* and CMX U series

*on request

AUTOMATIC 5-AXIS PRECISION MACHINING OF GUIDE VANES IN 3-SHIFT OPERATION

Recent improvements in the performance and accuracy of industrial robots mean that many new areas of application have opened up for robot-based solutions. A good example is the 5-axis milling cell from DMG MORI at LEISTRITZ Turbinentechnik Nürnberg GmbH. Comprising a DMU 40 eVo and the robotic workpiece loading system WH 8 CELL, the system marks the prototype of a cooperation between DECKEL MAHO Seebach GmbH and DMG MORI HEITEC GmbH.

As a company operating globally with its four business units – Turbine, Pump, Extrusion and Production Technology – the Leistriz Group manufactures demanding products and employs a high degree of innovation.

This also applies to Leistriz Turbinentechnik Nürnberg GmbH. “As a partner for all leading OEMs and supply chains in the aircraft engine industry, we focus on the production of

The aerospace industry, with its uncompromising approach to quality, precision and documentation, is among the most demanding and at the same time most complex of user industries. Added to this is the focus on cost reduction typical in international turbine manufacture. In order to ensure an even stronger position in the future under such conditions, the company recently invested in a robotic 5-axis milling system from DMG MORI for its guide vane production. DECKEL MAHO Seebach took over the task of supplying a turnkey solution for the project on behalf of DMG MORI.

More specifically, this future project concerns the automatic production of the shroud and root geometries of different guide blade variants for the compressor of an engine. The system marks the entry into robotics for the company from Nuremberg. “A true premiere in the field of automated metal machining”, explains Harald Brand.

Less than 2 days installation time thanks to the Digital Twin

Harald Brand sees no risk whatsoever and goes on to explain: “Firstly, the project will be supplied exclusively by DECKEL MAHO Seebach (machine, tooling, NC programming and automation), which also bears sole responsibility, so if the worst comes to the worst (which has never happened), we have just one point of contact. Secondly, the automation unit is made up of standard modules that have been configured individually.

AUTOMATION SOLUTION FROM A SINGLE SOURCE

blades, discs and other components for aircraft engines”, Harald Brand, plant manager of the aerospace specialist in Nuremberg, tells us about the company’s fields of activity.





Thirdly, the system has been put through its paces in advance at the supplier's premises as well as being specially tested on a Digital Twin virtual system that simulates our requirements. In a nutshell, we have rarely felt ourselves to be in such good hands and so well supported. This approach eliminates tedious installation and commissioning took less than two days."

It is apparent that the system has justified the confidence placed in the supplier and in the equipment. "After just a few months it is still too early to make any final conclusions", says head of engineering at Leistriz, Wolfgang Heinrich, "but the current situation indicates the most successful start to a project we have ever experienced in our plant. This is true for both the DMU 40 eVo itself as well as for its interface with the WH 8 CELL workpiece handling system." The number 8 in the name of the cell refers to the max. handling weight of 8 kg.

Markus Heinrich, head of production in Nuremberg, praises the DMU 40 eVo in particular for the following reason: "The machine achieves identically accurate results in a tolerance range of less than one hundredth of a millimetre in the morning, the evening and at night. And it does so day in, day out. »



1. The DMG MORI production cell was developed as a dedicated turnkey project for vane machining 2. Accurate results to a tolerance of less than one hundredth of a millimetre in 3-shift operation 3. Perfect accessibility, also for manual operation

**LEISTRITZ
TURBINENTECHNIK FACTS**

- + More than 100 years of experience in turbine technology
- + Production of blades, discs and other components for aircraft engines and land turbines
- + Partner to all leading OEMs and subcontract suppliers in the aircraft engine industry



LEISTRITZ
TURBINENTECHNIK GMBH
Lempstrasse 24
42859 Remscheid, Germany
www.leistriz.com





Our contact partners at LEISTRITZ Turbinentechnik GmbH in Nuremberg (from left to right): Wolfgang Heinrich (Head of Engineering), Harald Brand (Plant Manager), Akdas Serkan (Technologist and Programmer)

The DMU 40 eVo with a WH 8 CELL delivers the same consistently accurate results in a tolerance range of less than one hundredth of a millimetre.

Wolfgang Heinrich
Head of Engineering
LEISTRITZ Turbinentechnik Nürnberg GmbH



DMU 40 eVo

5-AXIS AUTOMATION FROM DMG MORI

HIGHLIGHTS

- + Customised automation as a modular solution: DMU 40 eVo with a robot-controlled workpiece handling system WH 8 CELL from DMG MORI HEITEC
- + 5-axis precision machining of aerospace guide vanes in uninterrupted 7-day operation
- + Shortest possible installation time thanks to digital pre-engineering and concurrent digital simulation
- + Impressive process stability and repeatability in 3-shift operation
- + Shortest possible machining times due to an acceleration of up to 1g and a chip-to-chip time of 5.5 seconds
- + Unrestricted accessibility to the work area for manual machining operations

This is truly a stroke of luck for our processes, because it enables us to improve the delicate interaction between the machine, fixture, handling equipment, process and tool to the absolute limits of what is theoretically feasible.”

Akdas Serkan, technologist at Leistriz and responsible for programming the system, goes on to explain in more detail: “Every tool is subject to process-related wear, which we need to address. Thanks to the stability of the processes we are now able to calculate the exact life cycle of the tools for each guide vane variant, taking the component tolerance into account, and can incorporate this data into the program.”

Three additional unmanned shifts thanks to an adaptive manufacturing process

This continuous improvement process has already been completed for some components. The remaining guide vane geometries will be made adaptively machinable in parallel with the ongoing operations.

“Ultimately, the multi-machine system will run from Monday morning through to Saturday evening, 52 weeks a year. In addition,

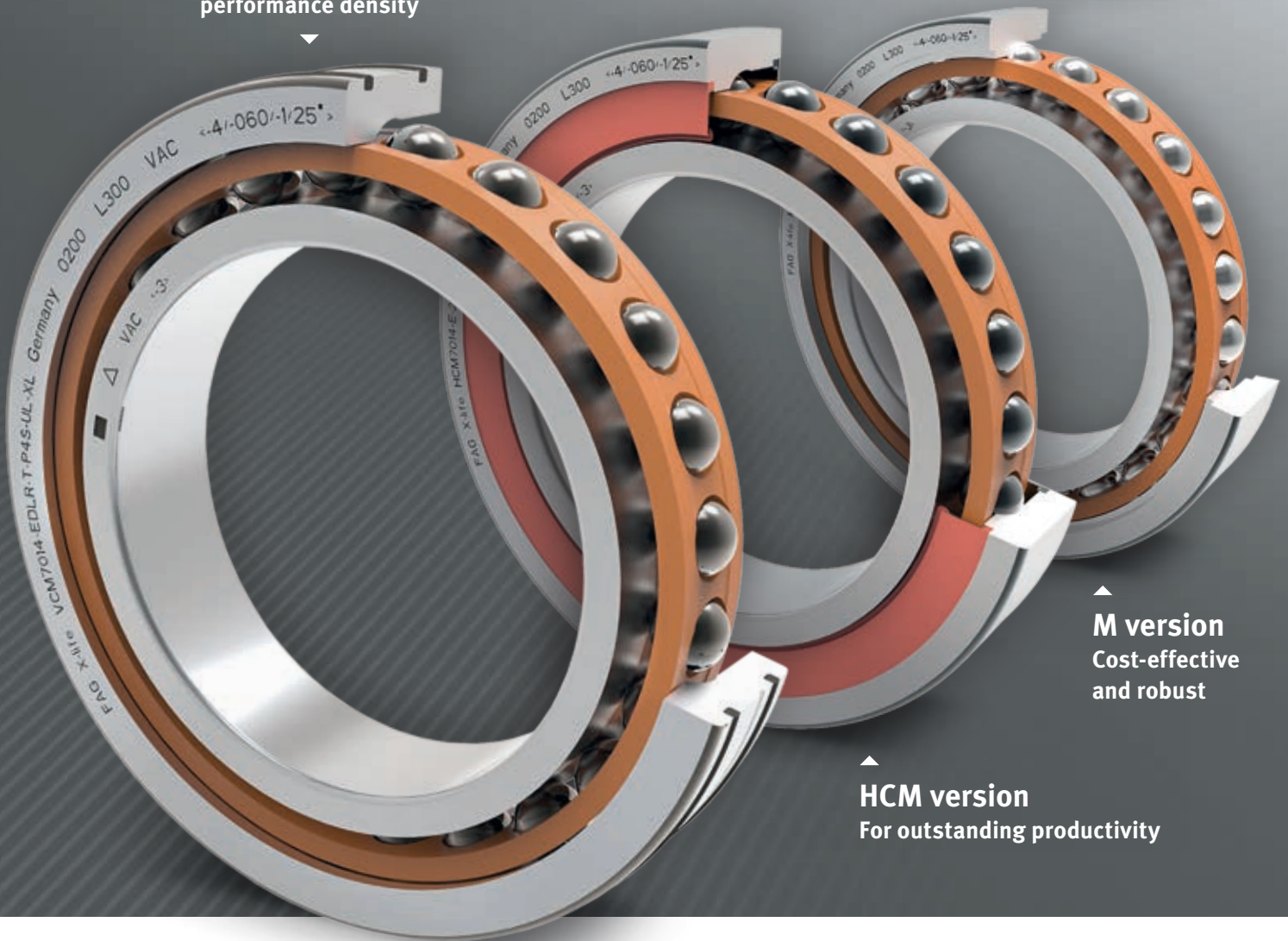
we will gain three shifts on currently unutilised Sundays, during which the system will operate completely automatically with no supervision”, enthuses Markus Heinrich. A quick comparison: The operator of milling machines requiring manual loading and unloading has to measure every tenth part (in compliance with the certified specifications) and is responsible for making any necessary adjustments to the program.

In contrast, the DMU 40 eVo machines the 60 blanks in the WH system as a complete batch without interruption. Three shifts are planned. Although the cell does not do away with the need to measure every 10th part (see certification), measuring takes place in-process and any necessary corrections are automatically incorporated into the CNC program. As this process route has proved completely reliable to date, the people at Leistriz in Nuremberg trust entirely in both the DMU 40 eVo from DMG MORI and in the automation competence of DMG MORI HEITEC.

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 X times longer service life

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SCHAEFFLER

“THE MORE COMPLEX THE WORKPIECE, THE BETTER WE LIKE IT”



The story of Wehl & Partner Muster + Prototypen GmbH started back in 1994 in a small garage with a domestic oven for curing moulds. A new modern building in Zimmern ob Rottweil, a location in Spain and a subsidiary in Salach are the outcome of continuous and successful business development 25 years on. With its staff of 80 skilled workers and 22 machines for metal cutting, additive manufacturing and injection moulding, Wehl

& Partner produces demanding samples and prototypes for customers in all industries. Where CNC technology is concerned, DMG MORI has been supplying the company with 5-axis DMU eVo *linear* machining centres, vertical machining centres from the CMX V series and CTX turning machines since 2012. 2016 saw Wehl & Partner's first step on the path of automated production with two DMU 60 eVo *linear* machines equipped with a robotic cell.

Versatile and reliable machining capacity from DMG MORI

One of the reasons for choosing DMG MORI as a supplier is its extensive portfolio. For the most part, Wehl & Partner relies on dynamic and high-precision DMU eVo *linear* machining centres when it comes to milling. Bernardo Wehl sees the versatile simultaneous 5-axis machines as the ideal solution for the company's demanding range of workpieces: "The more complex the workpiece, the more we



Gearbox housing for an e-bike

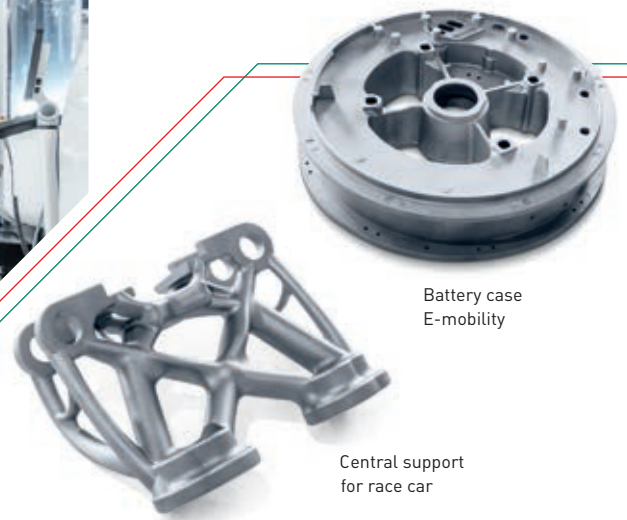


*We boost the productivity of the DMU 60 eVo *linear* enormously with the robotic cell.*

Bernardo Wehl with his sons Robert (left) and Alexander (right), members of the family that manage Wehl & Partner



1. The robot loads the DMU 60 eVo *linear* with up to 20 pallets or blanks.
2. DMG MORI supplies Wehl & Partner with 5-axis DMU eVo *linear* machining centres, CMX V series vertical machining centres and CTX lathes.



like taking on the order.” Orders come from the automotive, electrical and aerospace industries, among others, and range from power drill housings to instrument panels. Wehl & Partner also produces small batches in the company’s own injection moulding department. “Our high level of vertical integration also encompasses our own tool making shop for injection moulding”, adds Alexander Wehl.

Unmanned production thanks to the DMU 60 eVo *linear* with a robotic cell

Wehl & Partner meets continuously rising demand by expanding its production. The purchase of an automatic production cell was a logical consequence, according to Robert Wehl, who manages the business with his brother Alexander and his father Bernardo:

UNMANNED PRODUCTION AT THE WEEKEND

“The robotic cell boosts our productivity enormously, because it means we can exploit the capacity of the DMU 60 eVo *linear* to the full at night and at weekends. Our staff only work one and half shifts. We program the orders and set everything up during the day and then mill the parts at night.”

The Kuka robot loads the machine with up to 20 pallets or blanks. Its accompanying rack provides the necessary space. A turnover station enables the machining of the previously

clamped surface in a second process step. “In other words, completely machined parts are ready and waiting for us in the morning, which we can send straight off to be finished”, explains Alexander Wehl. Automatic reclamping has another advantage, according to Robert Wehl: “In contrast to manual clamping, no inaccuracies can occur when this is done automatically.” It is an important point, as many components are machined to an accuracy measured in microns.

Robotic cell for highly flexible one-off production

The DMU 60 eVo *linear* with robotic cell quickly impressed Wehl & Partner: “This automated system is a highly flexible solution for one-off production of batch sizes of 1, with which we can respond quickly while at the same time boosting production capacity.” Short delivery times are what customers want and are therefore what Wehl & Partner aspires to, as the founder of the company stresses: “It takes between one and two weeks from receipt of an order to delivery of the finished prototypes.” Wehl & Partner also helps its customers with development if required.

Expansion and technological progress

The holistic range of products and services and the company’s extensive level of expertise are the key drivers of growth at Wehl & Partner. Expansion of the factory is being planned, while the company is also developing technologically, says Robert Wehl: “Additive manufacturing is becoming an increasingly important addition to our portfolio, because we finish the parts from the powder bed on our CNC machines and can therefore offer everything from a single source.” «

WEHL & PARTNER FACTS

- + Family business founded in 1994
- + Headquarters in Zimmern ob Rottweil
- + 80 employees
- + Location in Spain, subsidiary in Salach
- + High level of vertical integration with metal cutting, additive manufacturing and injection moulding



Wehl & Partner
 Muster und Prototypen GmbH
 Römerallee 12
 Industriegebiet, IN-KOM Südwest
 78658 Zimmern/Rottweil
 Germany
www.wehl-partner.de





AUTOMATED PRODUCTION WITH INDUSTRY 4.0 SOLUTIONS

INTERCONNECTION WITH ROBOTS

- + Five DMU eVo 80 *linear* machines
- + 180 locations for pallets measuring 450 × 450 mm and weighing 250 kg
- + Two set-up stations and one off-load station
- + Camera system developed by LuK for simple location of the zero point during set-up
- + 120 tools per machine plus 105 tools in an external rack
- + Barcode reader for automatic transfer of tool data
- + FANUC robot with two grippers for pallets and tools



The linked DMU 80 eVo *linear* machines enable fully automatic and reliable one-hit manufacturing.

Wilfried Schwenk
Head of tool making at Schaeffler's factory in Kappelrodeck

The successful development of LuK GmbH & Co. KG, founded by Wilhelm und Georg Schaeffler, began in 1965 with the serial production of diaphragm spring clutches for the VW Beetle. Part of the Schaeffler Group, the company employs around 5,500 people at its locations in Bühl, Bußmatten, Sasbach and Kappelrodeck. The location in Bühl has been the Automotive OEM headquarters of the Schaeffler Group since January 2018. The company's innovative manufacturing processes are a key factor for ensuring its technological lead. The latest example of this is a flexible production cell comprising five DMU 80 eVo *linear* machines that DMG MORI developed and implemented in cooperation with Schaeffler within eleven months.

Products "Made in Germany" enjoy a great reputation worldwide. Equally great, however, is the challenge of manufacturing products economically, an issue Schaeffler tackles early on in the development and production of its tools. "Innovative forming technologies help us produce serial components with increasing efficiency", says Wilfried Schwenk, head of tool making at the Schaeffler location in Kappelrodeck, about the aims in this division. "The tools needed here are in such high demand that we deliver them as far away

as China, despite the fact that production is actually much cheaper there." That is why Schaeffler is continually on the look-out for cost saving potential, especially where tool making is concerned.

40 DMG MORI machines for high-precision production in tool making

A modern shop floor with more than 120 machining centres and turning machines helps the tool making division to continuously boost productivity. The 40 machines from DMG MORI are proving to be the innovative standard in tool making. At an early stage, complex workpieces in the highest accuracy classes were processed on an HSC 75 *linear* from DMG MORI. In 2007, an automated version of the same machine was added, explains Wilfried Schwenk: "The gain in productivity that we achieve through automation is enormous, because it means we can concentrate on preparing new orders while the machine is running unattended."

High-precision machining centres such as models from the DMU eVo *linear* series are standard in Schaeffler's production. "The modular design gives us the flexibility we need to equip our machines to suit the respective applications, so they can meet the high requirements demanded of them", »



From left to right: Andreas Glaser, responsible for machining at Schaeffler Group in Kappelrodeck, Wilfried Schwenk, head of tool making, and Marco Rettig, in charge of machine procurement.



says Marco Rettig, responsible for machine procurement at the Schaeffler factory in Kappelrodeck. "It is vital that the machines produce workpieces to impeccable quality and that they do so with the necessary efficiency", adds Andreas Glaser, in charge of machining.

Customised automation with five machines and 180 pallet stations

Schaeffler and DMG MORI have now raised the topic of automation to a new level by linking five DMU 80 eVo *linear* machines. The 30-metre-long system includes a tool presetter with a set-up station for tools, two set-up stations for workpieces and an off-load station in addition to the five machining centres. The data from tool presetting are transmitted to the machines automatically via a barcode reader at the set-up station, even before the robot places the tools in the external magazines. "These are used to store up to 105 special tools that are not needed so often", explains Andreas Glaser. "We load the 120 tool stations in the machines with standard tools and their sister tools." There is also a barcode reader on the machines for transmitting the tool data. A FANUC robot with two grippers for

pallets and tools works inside the system. The long rack has 180 stations for pallets measuring 450 x 450 mm and weighing up to 250 kg.

ONLY THREE INSTEAD OF NINE EMPLOYEES PER SHIFT

Jointly developed automation with artificial intelligence

With this automation solution, DMG MORI acted as the sole supplier of the production technology, tooling, NC programs and automation. When designing the system, there was also close cooperation with Schaeffler, which made implementing the requirements far simpler. Schaeffler, for example, was able to contribute its own in-house camera system for the set-up stations. The cameras scan every component and enable the operator to set a zero point on the PC. "Accuracy is to one-tenth of a millimetre, sufficient for

blanks with enough material allowance", says Andreas Glaser. Where necessary more accurate zero points are set using a sensor – also carried out automatically. It would be legitimate to speak of artificial intelligence where this automation is concerned stresses Wilfried Schwenk "The system manages orders, delivers finished parts, initiates the use of sister tools and corrects programs in the case of tool wear completely automatically and independently." In other words, we achieve reliable one-hit production of parts.

Only three employees per shift are needed to operate the entire automation system – Schaeffler was one of the first companies to introduce three shifts in tool making. "It represents a third of the manpower we would need for the same output without automation", says Wilfried Schwenk with reference to the high capacity. "On the other hand, we had to take on five new programmers to fill the plant with enough work." His statement also helps to dispel the fear of jobs being lost as a result of automated production. Quite the opposite: "Costs would be too high in the long term if we did not take this step in pro-

duction and this would lead ultimately to the loss of all jobs.” The same holds true for the production area: “We would need double the amount of space for machines and peripherals without automation.”

Digital future of automated processes

Tool making in Kappelrodeck is one of the biggest within the Schaeffler Group so consequently it also sets production standards to continuously increase quality and reduce workpiece costs. An example of this is the automation, according to Wilfried Schwenk: “We already have similar systems in Bühl and in a US location, with four and two DMU 80 eVo *linear* machines respectively.” What is more, the company is constantly considering further advances. “Digitisation of our processes is a promising area of development.”

While the DMU 80 eVo *linear* machines have been equipped with classic HEIDENHAIN controls to date, DMG MORI intends to offer future models with CELOS and HEIDENHAIN. “This would open up new possibilities for us where the management of order, machine and tool data is concerned”, says Wilfried Schwenk, looking forward to the possible networking that CELOS would enable. “Calculations we have made on the basis of empirical values up till now could then be backed by facts and incorporated into our processes automatically.” He is thinking here about the minimisation of vibrations during machining or about the procurement of tooling. “If we analyse in the cloud the service life of tools, we can set parameters for automatic ordering of new tools by our purchasing department.”

SCHAEFFLER FACTS

- + Innovative automotive products such as double clutch systems, dual-mass flywheels and CVT components at the locations in Bühl, Bußmatten, Sasbach and Kappelrodeck
- + Tool making in Kappelrodeck sets the production standards within the Schaeffler Group

SCHAEFFLER

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 77815 Bühl, Germany
www.schaeffler.com

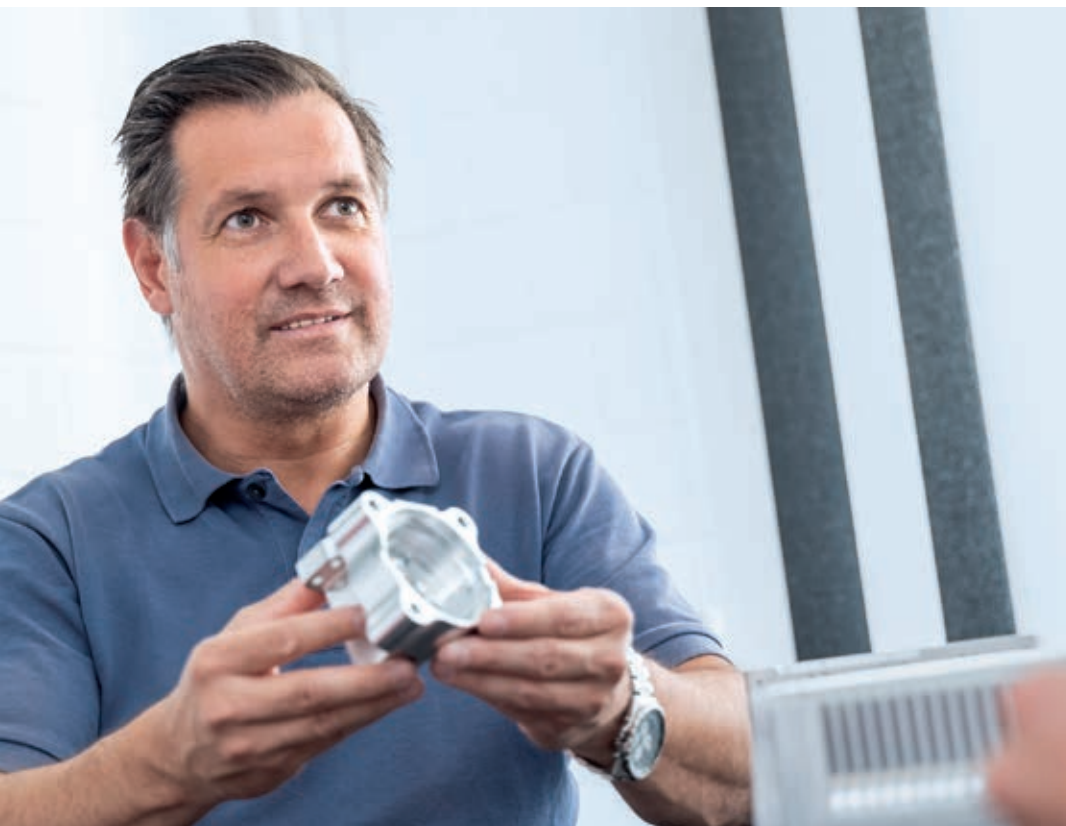


1. In addition to the 120 tool stations per machine, the automation also includes 105 stations for special tools. 2. The set-up stations are equipped with a camera system developed by Schaeffler, which enables the operator to set a zero point on the PC. 3. The 30-metre-long system includes five DMU 80 eVo *linear* machines, a tool presetter including a set-up station for tools, two set-up stations for workpieces and an off-load station.

KEEPING UP WITH THE TIMES

THROUGH AUTOMATED, HIGH-END MACHINING FOR RESEARCH & DEVELOPMENT

Pump housing



Frank Warnke, Managing Director of Ludwig Feinmechanik since 2014.

Ludwig Feinmechanik & Maschinenbau GmbH was founded in 1979 by Gerhard Ludwig. 1998 saw the company move to the Technologiepark Uni Bremen and the start of close cooperation with the companies and research institutes located there. These include the Fraunhofer Institute and the German Aerospace Centre, for example. 14 skilled staff and ten CNC machines from DMG MORI ensure high quality, reliable production of demanding one-offs and batches of parts. A 5-axis DMU 50 3rd Generation machine with a PH 150 pallet handling system – the latest acquisition – boosts efficiency in production.

ficonTEC Holding took over the company in 2014 after Gerhard Ludwig retired. Frank Warnke, the new Managing Director, had the goal of continuing the successful course of Ludwig Feinmechanik, but also turned to industry where he built up a second foothold for the company in addition to the customer base in the technology park. From then on, larger series of up to 2,000 parts were added to the many smaller quantities: "The high level of quality has stayed the same." Ludwig Feinmechanik is a specialist in the production of complex components for general mechanical engineering and the aerospace industry, among others. "Such orders require a lot of manufacturing competence, which

we ensure with our team of highly skilled staff", says Frank Warnke. For many years now the team has relied on machine tools from DMG MORI, which Frank Warnke has continuously modernised. The reason: "On the one hand, machine availability is higher with new models and on the other, we have to keep technologically abreast of the times."

TEN PALLETS IN A FOOTPRINT OF 16.5 m²

Unmanned night and weekend shifts

The latest models in production include a DMC 1450 V for vertical machining and a DMU 60 eVo *linear* for 5-axis simultaneous machining. A DMU 50 3rd Generation with a PH 150 pallet handling system in the recently launched VERTICO design has enabled automated production at Ludwig Feinmechanik since earlier this year. "Unmanned night and weekend shifts increase our productivity enormously", says a pleased Frank Warnke. The operator can prepare ten pallet stations with completely different individual parts and then remove them the next morning or after the weekend.

Complete system with ten pallets in a footprint of less than 16.5 m²

The manufacturing solution with a DMU 50 3rd Generation and PH 150 has impressed Frank Warnke on many different levels: "Our production area is limited, so the compact design with ten pallets in a footprint of less than 16.5 m² was an important criterion for us." The relatively large work area for workpieces of up to 300 kg is another positive feature. "It means we can cover a wide range parts."

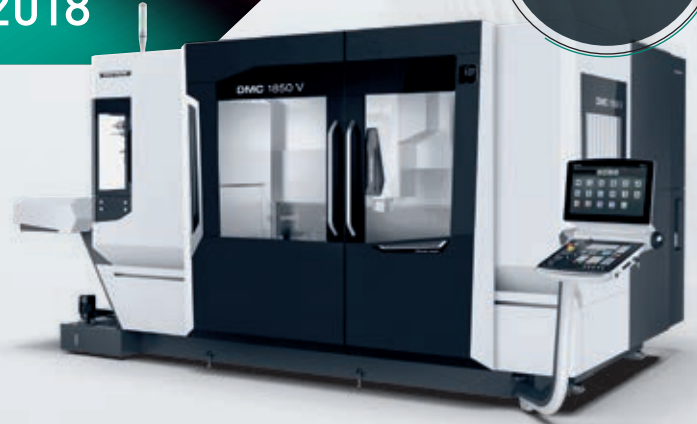
5-axis simultaneous machining, 15,000 rpm speedMASTER spindle and the ergonomic DMG MORI design

The performance and range of functions offered by the DMU 50 3rd Generation are also appreciated at Ludwig Feinmechanik. "5-axis simultaneous machining, a high-performance spindle and cooling system for maximum precision all add up to a good overall package »

**WORLD
PREMIERE
2018**

DMC 1850 V

HEAVY DUTY
MACHINING UP
TO 288 Nm



DMC 1850 V

**"WITH ITS HIGHLY STABLE
MACHINE BED AND THE OPTIONAL
288 Nm SPINDLE, THE DMC 1850 V
IS IDEALLY SUITED TO HEAVY
DUTY MACHINING"**

HIGHLIGHTS

- + One-piece machine bed for **heavy-duty cutting with up to 288 Nm**
- + **inlineMASTER, speedMASTER and powerMASTER** spindle up to 20,000 rpm or up to 288 Nm
- + **36 months warranty** on all **MASTER spindles** with unlimited running hours
- + 2,160 x 750 mm table for processing **large workpieces up to 3,000 kg** or **unattended machining** of many small workpieces
- + **5 µm** circularity and thermal stability through comprehensive cooling and **smartSCALE measuring system** from MAGNESCALE
- + **CELOS with SIEMENS** or **CELOS with HEIDENHAIN (TNC 640)**



inlineMASTER* spindle with 15,000 rpm, optional speedMASTER up to 20,000 rpm or 200 Nm, or powerMASTER* spindle with 288 Nm (SK50).

*available as of Q2 / 2019



at an attractive price”, claims Frank Warnke. The compact 5-axis machining centre has a swivel range of between -35° to $+110^{\circ}$ while the speedMASTER spindle operates at up to 20,000rpm with 35kW and 130Nm. New is the 36 months warranty with unlimited running hours that DMG MORI now offers for all

speedMASTER spindle with 130 Nm and 36 months warranty

MASTER spindles. Frank Warnke is also pleased with the DMG MORI design – for ergonomic as well as visual reasons: “The clear view into the work area and the pallet handling system plus the good accessibility to the machine both make set-up easier.” The automation solution from DMG MORI was a good way for Frank Warnke to boost productivity, despite the limited space available in the technology park and the lack of skilled employees: “The combination of a DMU 50 3rd Generation and PH 150 will certainly be on the short list of choices for our next machine purchase.”

«

LUDWIG FEINMECHANIK & MASCHINENBAU FACTS

- + CNC experience since 1979
- + 14 highly qualified specialists
- + Complex single parts and series up to 2,000-off

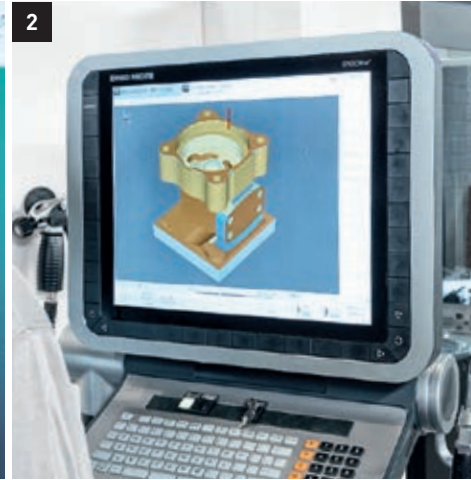


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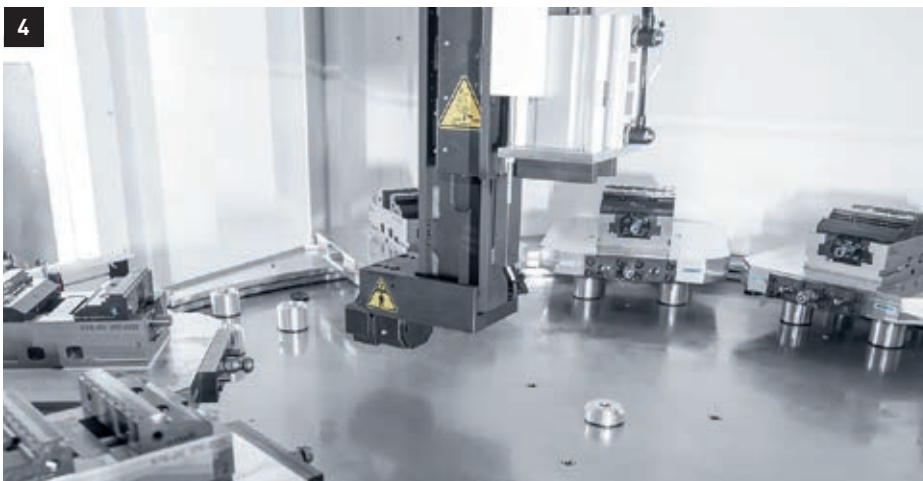
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2



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4



5



6



7

- 1+2. Programming of complex workpieces is carried out on a PC.
- 3. Easy-to-use PH 150 pallet handling system.
- 4. The compact 16.5 m² automation solution has space for ten pallets and a work area for workpieces weighing up to 300 kg.
- 5. Ludwig Feinmechanik took its first step into automatic production in 2018 with the installation of a DMU 50 3rd Generation machine plus PH 150 pallet handling system of the DMG MORI VERTIGO design.
- 6. The DMU 50 3rd Generation offers 5-axis simultaneous machining, a high-performance spindle and cooling system for maximum precision at an attractive price.
- 7. Its multitude of different parts means that Ludwig Feinmechanik depends on flexible machining solutions such as the DMU 50 3rd Generation combined with a PH 150 pallet handling system.

**WORLD
PREMIERE
2018**

NHX 4000 & 5000 3rd GENERATION

THE NEW STANDARD IN HORIZONTAL MACHINING CENTRES

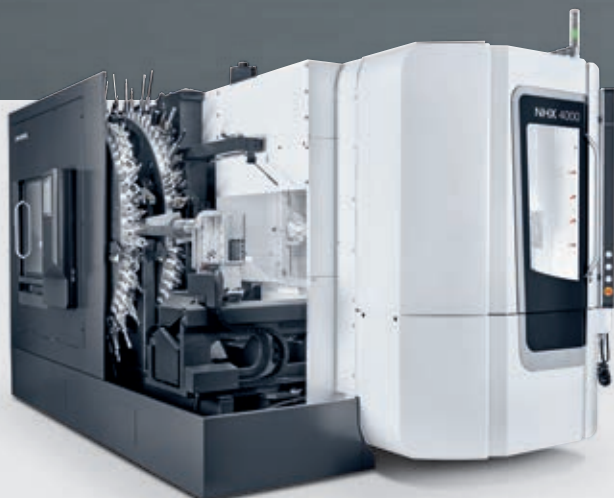
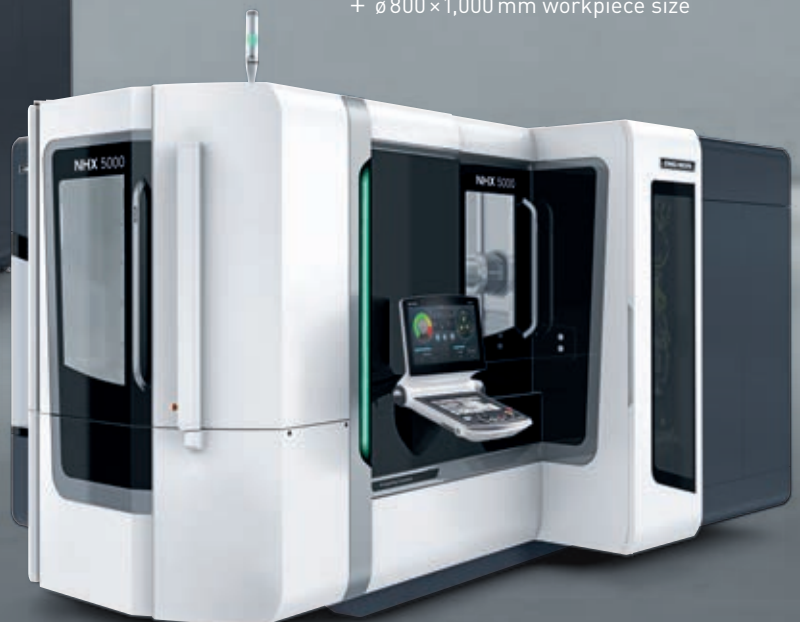


NHX 4000

- + 400 × 400 mm pallet size
- + 400 kg pallet load
- + ø 630 × 900 mm workpiece size

NHX 5000

- + 500 × 500 mm pallet size
- + 500 kg pallet load (700 kg optional)
- + ø 800 × 1,000 mm workpiece size



PATENTED WHEEL MAGAZINE (AVAILABLE FOR NHX 4000/5000 WITH SIEMENS)

- + **Most compact magazines on the market**
(41% less width for 123 tool slots)
- + **Tool replenishment during machining and idle times**
(with 2 wheels, 123 tools)
- + **Up to 303 tool pockets** (123, 183, 243, 303)
- + **3 sec. chip-to-chip time, max 5.6 sec. tool change time**

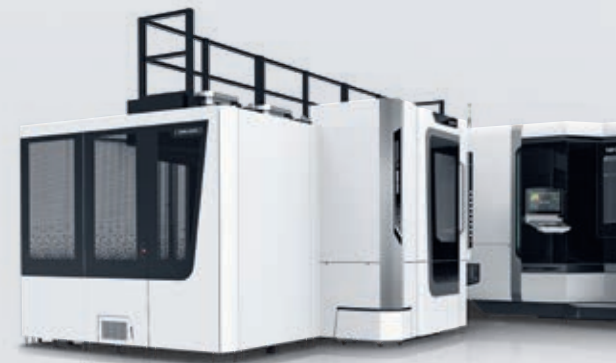


RPS – ROTARY PALLET STORAGE

RPS – PALLET POOL SYSTEMS WITH COMPACT FOOTPRINT AND OUTSTANDING CAPACITY

HIGHLIGHTS

- + **Rotary Pallet Storage** with 5, 14 or 21 additional pallets, up to 23 pallets in total // SIEMENS: 7 or 12 pallets in total
- + **500 × 500 mm** maximum pallet size, **700 kg** max. pallet load
- + **ø 800 × 1,000 mm** max. workpiece size



CPP & LPP

FLEXIBLE PALLET HANDLING SOLUTIONS FROM 5 UP TO 99 PALLETS

HIGHLIGHTS

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

CPP – Compact 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 information about automation can be found here:
automation.dmgmori.com



5.6 sec. chip-to-chip time, 0.5 sec. tool change time



7 OUTSTANDING TECHNOLOGIES IN THE STANDARD VERSION

1. **speedMASTER 20,000 rpm with 221 Nm**
 - 740 cm³/min in CK45
 - M42 Tapping in CK45 (15,000rpm with 250Nm optional)
2. **toolSTAR magazine with 60 pockets**
 - 2.2 sec chip-to-chip time (NHX 4000)
 - Integrated tool breakage control
3. **Chip conveyor with integral tank and cyclone filter,** and 15 bar coolant unit
4. **100 rpm NC rotary table (DDM)**
5. **Extended hydraulic clamping interface,** as an “auto coupler” (from below) and fixed from above for a higher level of flexibility in automation
6. Optimised cast parts for higher dynamics and stability, and **smartSCALE measuring system from MAGNESCALE**
7. **CELOS with MAPPS on FANUC**
CELOS with SIEMENS

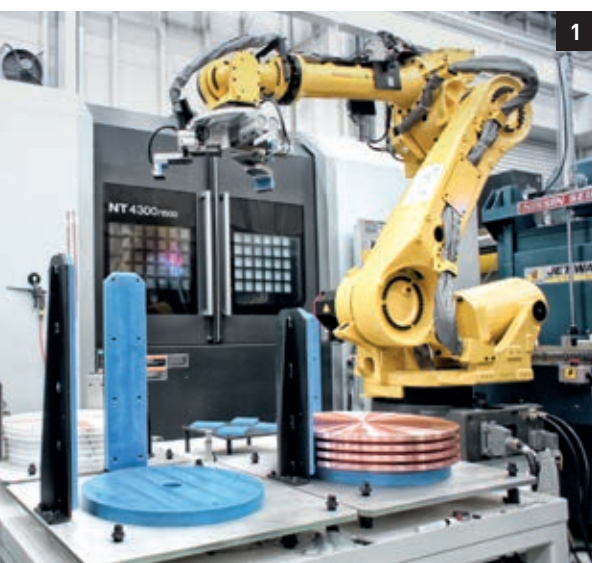


Outer wheel with 63 available tool pockets,
Inner wheels with 60 available tool pockets.

50% HIGHER PRODUCTIVITY THANKS TO AUTOMATIC TURN & MILL MACHINE



Mr. Masatoshi Fujii
President



1. NT 4300 DCG with robot system
2. Mr. Shinji Kono, Deputy Area Manager 1, Manufacturing;
Mr. Yuhei Tozawa, Area Manager 1, Manufacturing;
Mr. Yuya Chiba, Manager, Area Manager 1, Manufacturing;
Mr. Masatoshi Fujii, President

Fuji Metal specialises in the processing of non-ferrous metals. The majority of sales originate from the production of materials for use in sputtering machines which are necessary in the manufacture of semiconductors. This requires special processing expertise in the handling of materials which, compared with iron and other common materials, can be particularly hard, sticky or brittle. Fuji Metal has carved out a market-leading position for itself in this sector.

70% less production area thanks to automated NT 4300 DCG

The original process consisted of three machine tools with three operators but has now been combined on one NT 4300 DCG multi-axis machine with robotic automation. The fact that only one machine is required has enabled the production area to be reduced by around 70%. The use of robots also enables unmanned operation overnight and at weekends. This in turn increases productivity by 50%. "Although it was a massive investment for a small or medium-sized company such as ours, extending the working time to about 20 hours a day increases the production capacity 2 ½ times," says President Masatoshi Fujii, showing great confidence in his decision.

In the ultramodern Fuji factory, the three DMG MORI multi-axis machines are each coupled to a robot which automates the whole process from setting-up to post-machining washing. "Investing in plant and machinery has enabled us to meet the increasing demands on production. This is why we opted for automation," argues President Fujii, in favour of an automated approach.

Breakthrough thanks to a DMG MORI solution

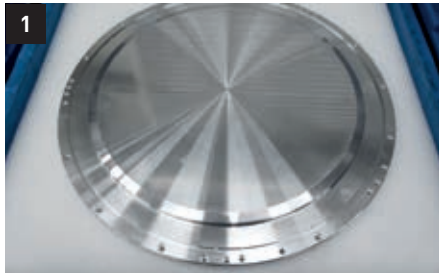
"Although we were familiar with the advantages of process integration, we did not believe that this was possible for us," says President Fujii retrospectively. Chip removal in particular appeared to be a problem. However, DMG MORI was able to call upon a broad knowledge of European peripherals and solved the problem of process integration with a high-pressure coolant unit for improved chip removal.

Amortisation by means of DMG MORI's robot solution

When purchasing a multi-axis machine, higher investment costs cannot be avoided. "To enable this investment to be amortised, Fuji Metal had no other choice than to increase productivity to an unprecedented level." DMG MORI therefore automated the process in order to extend production to nights and weekends. This was the solution that enabled President Fujii to achieve a positively explosive increase in productivity: "The comprehensive support by DMG MORI, which provided all automation system components from a single source, has certainly convinced us".

The key to success lay in a young team with fresh ideas

This was the company's first attempt at running an automated factory. "We knew nothing about automated manufacturing. For this reason, we searched internally for staff to make up a small and young team," says President Fujii. As a rule, younger members of staff



1. Example of a workpiece with a blank weight between 40 and 50 kg 2. Automatic robotic loading of the NT 4300 DCG

are more skilled in programming than the "old hands". "They see programming rather as a kind of game. This enables them to operate the automated machines even faster than expected".

«

FUJI METAL FACTS

- + Founded in 1985
- + More than 30 years' experience in processing materials for sputtering machines (semiconductor industry)
- + Specialises in processing non-ferrous metals



FUJI METAL Co., Ltd.
2 Chome-7-16 Hinode,
Kawasaki-ku, Kawasaki-shi,
Kanagawa-ken
210-0824, Japan
www.fuji-metal.co.jp



NEW



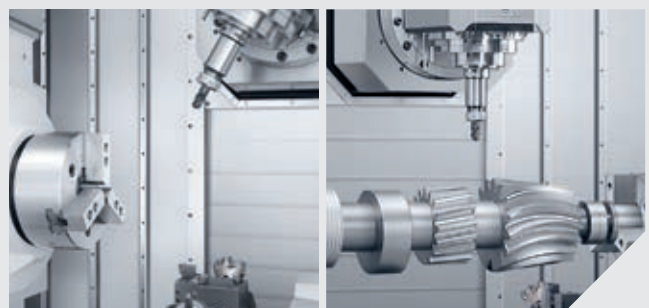
< 16.5 m²
FOOTPRINT

NTX 2000 / 2500 / 3000

BEST IN CLASS TURN & MILL – turnMASTER WITH 1,194 Nm AND compactMASTER WITH 132 Nm

HIGHLIGHTS

- + **turnMASTER** spindle:
 - NTX 2000: 8" chuck, 5,000 rpm, max. 421 Nm
 - NTX 2500: 10" chuck, 4,000 rpm, max. 599 Nm
 - NTX 3000: 12" chuck, 3,000 rpm, max. 1,194 Nm
- + **compactMASTER** Turn & Mill spindle with 132 Nm torque and 350 mm length
- + **Multitasking:** Direct Drive B-axis for 5-axis simultaneous machining of complex workpieces
- + **High flexibility** thanks to X-axis travel up to -125 mm below the spindle centreline
- + **CELOS with MAPPS on FANUC** and **CELOS with SIEMENS** available



6-sided complete machining of complex workpieces up to ø670 mm and 1,500 mm in length with the compactMASTER Turn & Mill spindle and second tool carrier (lower turret) with 80 mm Y-axis



Find out more about the NTX 2500 at:
ntx.dmgmori.com



ROBOTS

AS PRODUCTION AIDS





LÜBBERING invested in building a new, modern and contemporary production plant as early as 2000.



Markus Füchtenhans
Director of Manufacturing Technology
and authorised signatory
of LÜBBERING.

Johannes Lübbering GmbH, located in Herzebrock, East Westphalia, is a leading manufacturer of high precision tools in the fastening and drilling technology sector. With its 200 skilled employees and unique technological ideas, the family-run business produces complex products for virtually all automobile and aircraft manufacturers. Around 30 partially automated machine tools from DMG MORI have played a dominant role in the high level of vertical integration at LÜBBERING since as far back as the 1980s. One of the company's latest purchases is the Robo2Go, a flexible robotic automation system for turning centres in the CTX series.

Drilling and fastening systems in automotive assembly lines are becoming increasingly complex, because manufacturers are installing more and more components in the limited space they have at their disposal. The aerospace sector is just as demanding, explains Markus Füchtenhans, Director of Manufacturing Technology at LÜBBERING: "Safety-critical components have to be mounted reliably with hand-operated drills. We have always been the problem solver for our customers". The creative ideas incorporated into LÜBBERING units are imbued with all the basic concepts of classical manufacturing. The modern machines on the shop floor support the team in machining by EDM and grinding. Around 30 machine tools from DMG MORI are installed in the turning and milling section alone.

Process optimisation through automated complete machining

LÜBBERING has been using CNC equipment from DMG MORI since 2000 and started very early on with complete machining of complex workpieces, recalls Markus Füchtenhans: "As we are continuously optimising our processes, this step was just as logical as the entry into automated production with a DMC 650 V with PH 150 | 8 pallet handling system in 2014." Autonomous machining boosts capacity and supports employees: "While the production systems are fulfilling orders, our specialists operate other machines or concentrate on programming and quality control." That is exactly why we continue to depend on well-qualified engineers.

»



LÜBBERING supports its skilled staff on the CTC turn & mill centres with a Robo2Go from DMG MORI.

Robo2Go – a standard automation system for flexible use with several machines

Another significant step forward was the automation of turning machines. Since 2016, LÜBBERING has been using a Robo2Go on a CTX beta 1250 TC, the standard automation DMG MORI offers from a single source. The user-friendly, standard solution enables operators to relocate the Robo2Go to other turning machines with very little time and effort. "The magazine for 72 workpieces means we can produce autonomously right through into the weekend." The company works three shifts during the week. "We have fewer people working at night, so the Robo2Go operates then for longer periods without supervision."

Simple programming without any knowledge of robots

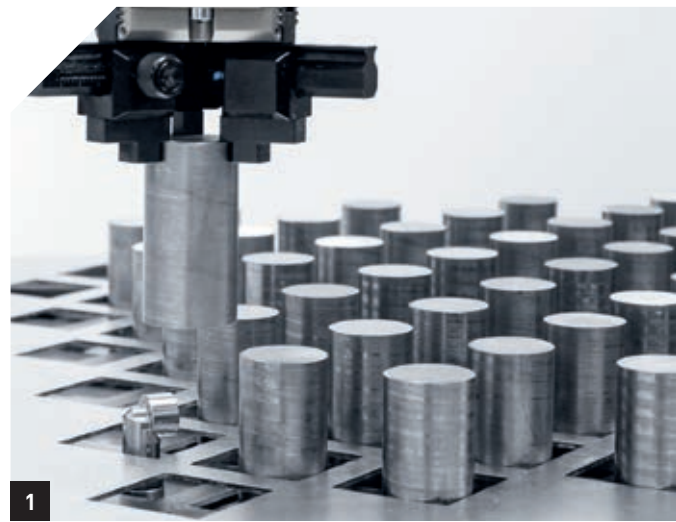
No robot programming knowledge is needed for programming the Robo2Go, so virtually any user can teach the robot in a very short time. The Robo2Go takes a blank from the magazine and a second gripper unloads the machined workpiece from the counter-spindle before the blank is clamped into the main spindle. The finished part is placed into the now-free magazine space. The robot has a load capacity of 10 kg and it can move workpieces of up to $\varnothing 100 \times 250$ mm.

Danger zone monitoring by laser

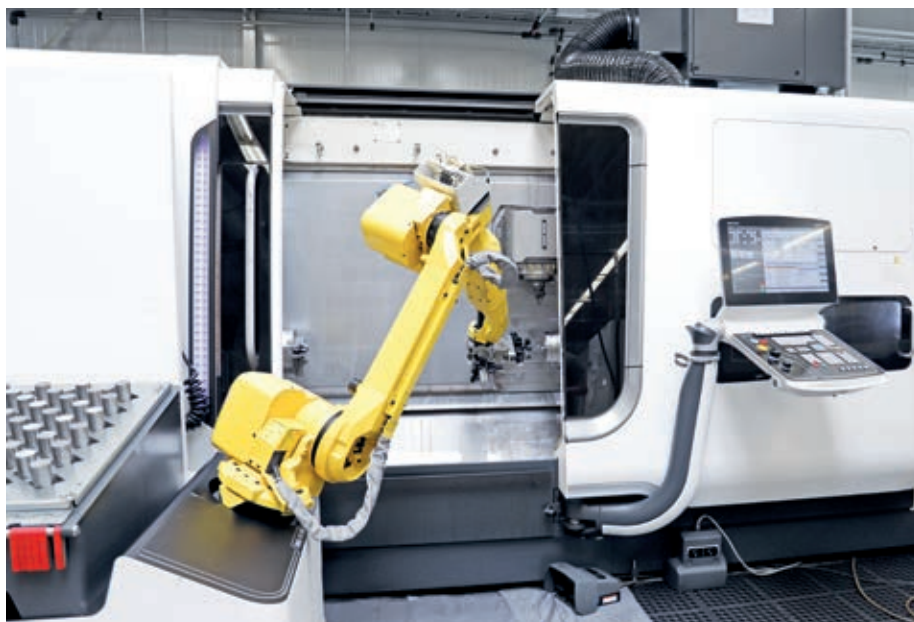
A special feature of the Robo2Go is its laser-based danger zone monitoring. As soon as an operator enters a defined yellow area while the system is running, the robot slows down. The red area leads to a shutdown, after which the Robo2Go has to be re-started. "This measure is necessary for reasons of industrial health and safety", explains Markus Füchtenhans. "But it also has an added space-saving benefit in that the Robo2Go can do without protective guarding."

Digital shop floor control with PRODUCTION PLANNING from ISTOS

Automation solutions such as the CTX beta 1250 TC with Robo2Go are building blocks for LÜBBERING on its path to Industry 4.0. Markus Füchtenhans points out some digital processes that already exist: "We use PRODUCTION PLANNING on the shop floor, an advanced planning tool from ISTOS that manages our processes from the blank through to shipment of the finished part. In addition, we have started a project with ISTOS for increasing machine connectivity." As automated manufacturing solutions fit in perfectly here, LÜBBERING already has its eye on the next purchases from DMG MORI, namely two DMC 60 H *linear* machines linked via a linear pallet storage system.



1. The magazine of the Robo2Go has space for 72 workpieces. 2. The Robo2Go unloads the finished parts from the counter-spindle and loads the main spindle with new blanks – fully automatically.



Unloading of the finished workpiece from the counter-spindle by the Robo2Go.

LÜBBERING FACTS

- + Leading manufacturer of high-precision tools in the fastening and drilling technology sector
- + CNC experience since the 1980s
- + 200 skilled workers at its headquarters in Herzbrock

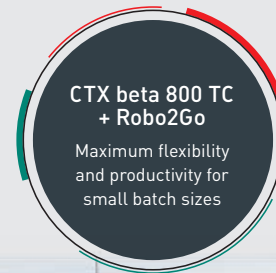


Johannes Lübbing GmbH
 Industriestraße 4
 33442 Herzbrock-Clarholz,
 Germany
www.luebbing.de



ROBO2GO

THE NEW ROBO2GO 2nd GENERATION FLEXIBLE WORKPIECE HANDLING, SIMPLE TO PROGRAM



**CTX beta 800 TC
+ Robo2Go**

Maximum flexibility
and productivity for
small batch sizes

Availability:
CLX, CTX alpha
CTX beta
CTX 2500
CTX beta 4A
CTX beta TC



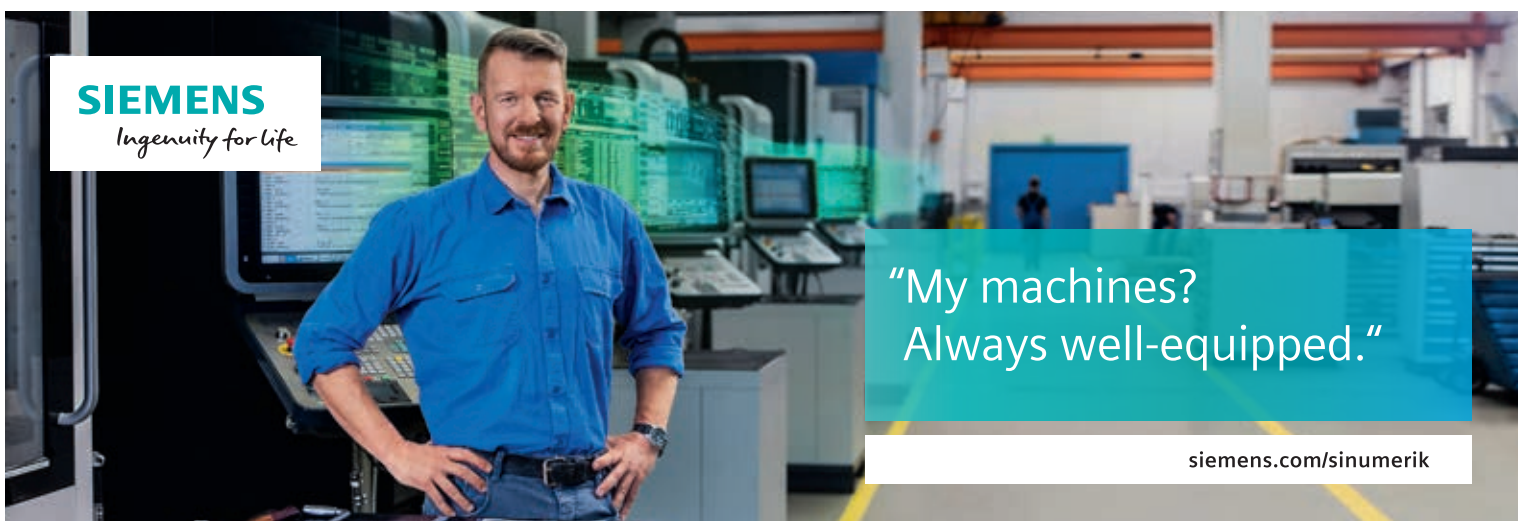
5 NEW FUNCTIONS

1. **NEW:** Open programming with drag & drop for maximum flexibility – Simple robot teaching in < 15 min.
2. **NEW:** Handling of shafts $\varnothing 25 - 150$ mm and chuck parts $\varnothing 25 - 170$ mm
3. **NEW:** Modular gripper system, external and internal gripping as standard
4. **NEW:** Stacking of workpieces
5. **NEW:** 20% higher capacity of the workpiece tray
+ Robot load capacity 10/20/35 kg
+ Simple relocation to a different turning machine in < 30 Min.
+ Simultaneous use with bar feeder possible

USER-FRIENDLY – MACHINE AND AUTOMATION INTEGRATED IN ONE CONTROL

- + Conversational control via CELOS
- + No programming knowledge required
- + Creation of a process with pre-defined modules
- + Creation of customised workpiece trays
- + Multijob function: different orders on one workpiece tray

1. Simple set-up on a different turning machine in < 30 min 2. Create process with predefined program modules 3. Individual trays and Multijob function – place several orders on one workpiece tray – ideal for small and medium batch sizes



SIEMENS
Ingenuity for life

“My machines?
Always well-equipped.”

siemens.com/sinumerik

CLX 450

NEW: WITH 800 mm TURNING LENGTH
AND 6-SIDED COMPLETE MACHINING
THANKS TO A COUNTER SPINDLE

CLX/CMX
CUSTOMISED
AUTOMATION
CAPABILITY!

NEW

HIGHLIGHTS

- + Workpieces up to $\varnothing 400$ mm and 800 mm turning length (max. $\varnothing 315$ mm in conjunction with a Y-axis)
- + High-torque 4,000 rpm main spindle with max. 426 Nm and 25.5 kW
- + $\varnothing 80$ mm bar capacity, chuck diameters 210, 250 or 315 mm
- + 120 mm Y-axis* for eccentric machining
- + 6-sided complete machining thanks to counter spindle* up to 5,000 rpm, 192 Nm and 14 kW (40 % DC), incl. Y-axis
- + Direct linear scales from MAGNESCALE in the X and Y-axes, optional in the Z-axis
- + Available with SIEMENS or FANUC, both with a 19" touch screen

*optional

<6.7 m²
FOOTPRINT



CMX V

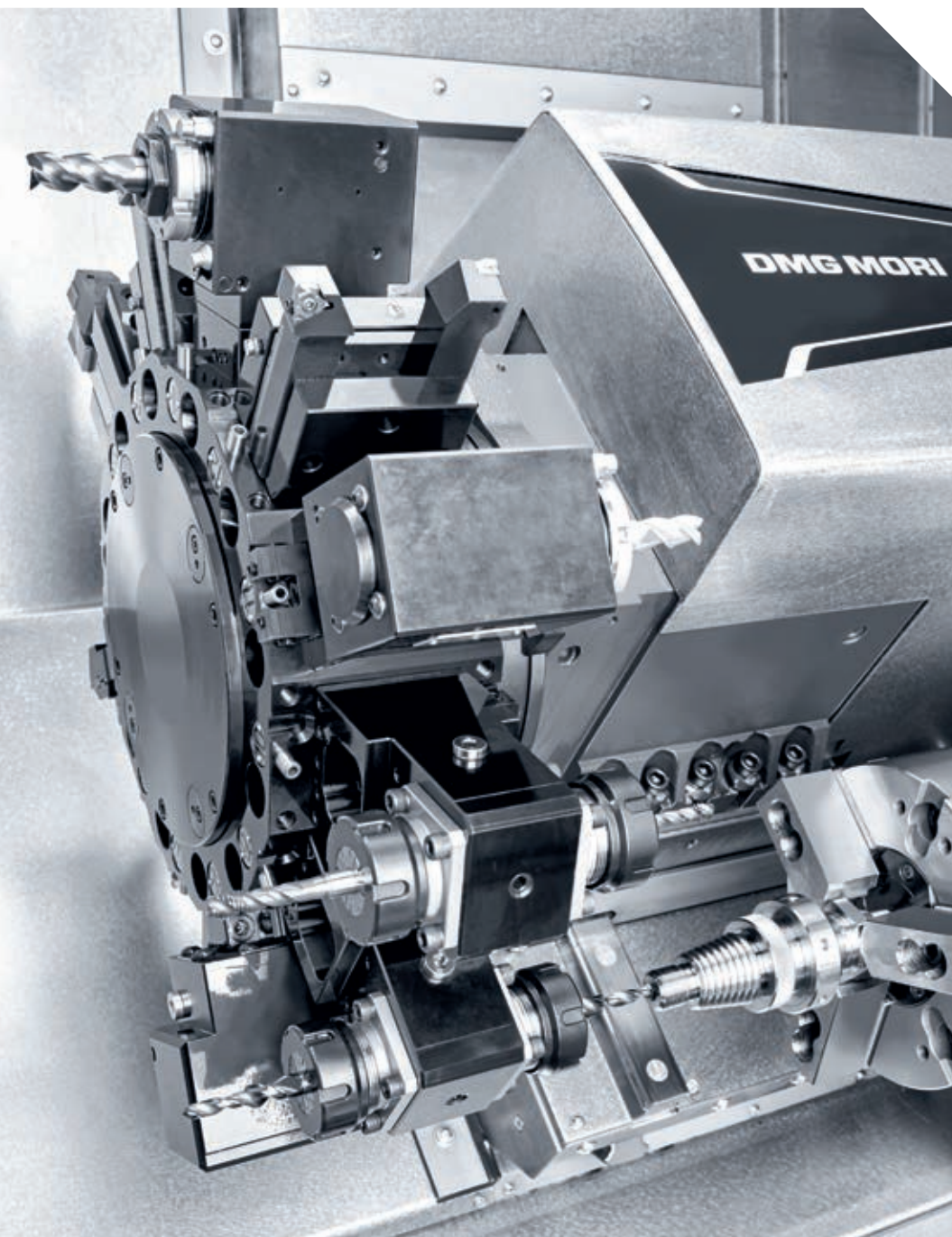
PH 150 PALLET HANDLING SYSTEM MADE BY DMG MORI

HIGHLIGHTS

- + Operation directly via the machine control, no additional external control
- + Max. load capacity 150 kg (250 kg as an option)
- + Clamping for 2 pallet sizes: ten 320×320 mm pallets, or six 400×400 mm pallets
- + <40 sec. pallet change time
- + SCHUNK clamping system VERO-S with 112 kN clamping force
- + Available for the CMX V and CMX U, DMC V, DMU 50 monoBLOCK, DMU eVo, etc.

NEW





Powerful counter-spindle with 5,000 rpm and 192 Nm (40% DC).



NEW

NEW

Robo2Go 2nd GENERATION FOR THE CLX

HIGHLIGHTS

- + Conversational programming, **no prior knowledge necessary**, integrated in the machine control
- + **Fast and simple teaching of the robot in <15 min.**
- + Handling of workpieces **up to ø 170 mm**
- + **Three versions:**
Load capacities 10/20/35 kg
- + **Modular gripper system**,
internal and external gripping in the standard version (freely selectable)

CMX V & CMX U

WORKPIECE HANDLING WH 8 CELL FOR THE CMX V* AND CMX U

HIGHLIGHTS

- + **Modular automation system** for workpieces up to 8 kg
- + **Two workpiece magazine systems:**
 - 2x (3x optional) trays for 140 mm workpiece heights, trays: 600x800 mm, max. 150 kg load capacity
 - Pallet magazine for 50 or 110 mm workpiece heights; pallets: 600x400 mm, max. 20 kg load capacity
- + Incl. Kuka KR10 and SCHUNK single or double gripper, incl. customer-specific gripper jaws
- + **Expansion options** (optional): SPC drawer, slide for rejects, parts blow-off station and turnover device

*on request



NEW



AUTOMATED 24/7 PRODUCTION ON 18 LINKED NLX 2500s

In the course of its more than 600-year history, Eisenwerk Erla GmbH in the Saxon town of Schwarzenberg has become one of Germany's most efficient and up-to-date jobbing foundries. Eisenwerk Erla derives 90% of its turnover from the automobile industry. Audi, BMW, Daimler and VW, and also suppliers such as IHI and BorgWarner, have for many years placed their trust in exhaust system components and engine parts from the company in the Ore Mountains. In 2016, Eisenwerk Erla extended its product range thanks to an order from a major automobile manufacturer. The company produces the engine components on 18 linked NLX 2500|700s, three of the DMG MORI Mill & Turn centres being linked by a portal handling system. The products include different variants of components for three-, four- and six-cylinder engines.

With an investment of around 7 million euros, the foundry converted an old boiler house and prepared it for installing the CNC machines. "At first, we wanted to load the machines manually," says Dietmar Hahn, CEO of Eisenwerk Erla, discussing the original plan. However,

DMG MORI then proposed a completely automated production system. "The design of the linked milling and turning centres – all NLX 2500|700s – impressed us both from a qualitative and from an economic point of view".

Throughput times of only 100 seconds

A foreman, a material flow coordinator and three machine operators work in the machine shop on each shift. Rico Klotz was involved in setting up the production department from the very beginning and is today in charge. "Production should be as simple as possible for all staff in order to minimise the risk of error". Every finished component is therefore checked for accuracy in special fixtures. "We use similar fixtures for periodic inspection in the metrology department and the transport boxes are standardised so that components can be removed by robots during assembly and installed immediately.". Five of the six linked production cells are absolutely identical; one is also designed for longer components. As far as the machines are concerned, Eisenwerk Erla chose three NLX 2500|700s as, according to Rico Klotz, the turning and milling centres enable shorter chip-to-

chip times. "This enables us to reduce our throughput times to about 100 seconds for each workpiece". The highlight is the BMT turret from DMG MORI. Its maximum speed is 10,000 rpm and the torque is up to 40 Nm.

Turnkey project: 18 linked NLX 2500s including programming from DMG MORI

The automated production process starts with loading the machines with forged blanks. A laser detects the type of components, each of which is moved to an exact position before it is picked up by the robot, therefore ensuring that it is correctly clamped in the machine. "The first machine drills holes and mills datum surfaces. The second produces the surface contours. The third machine mills further slots," says Rico Klotz, explaining the process. In the meantime, two rotating turn-over stations move the workpieces into the correct position. For DMG MORI, the installation of the 18 linked machines was a turnkey project which also included writing the associated programs. "Since making small adjustments to the implementation, the system has been running with virtually no problems," sums up



1



2

1. In 2016, Eisenwerk Erla established an automated machine shop comprising a total of 18 linked NLX 2500s 2. The robot removes the blanks from the conveyor belt

Rico Klotz after just over a year. A reject rate of less than 1% is impressive proof. "This guarantees that only fault-free components are sent to the customer".

«

EISENWERK ERLA FACTS

- + Around 340 highly specialised employees
- + 90% of turnover in the automobile industry
- + One of Germany's most efficient and up-to-date jobbing foundries



EISENWERK ERLA
JKM ERLA AUTOMOTIVE™

Eisenwerk Erla GmbH
Gießereistraße 1
08340 Schwarzenberg, Germany
www.eisenwerk-erla.de



NLX 2000 | 500 WITH GANTRY LOADER GX 5



GANTRY LOADER GX5
FOR THE
NLX 2000 AND
NLX 2500 | 500
(700)

NLX WITH GANTRY LOADER GX5

INTEGRATED AUTOMATION – FROM RAW MATERIAL TO THE FINISHED WORKPIECE

HIGHLIGHTS

- + Workpieces up to $\varnothing 120$ mm and 120 mm long, 2x5 kg transfer weight
- + Stacking magazine with 2 loading stations and **14, 20, or 26 pallet positions;** 35 kg load capacity per pallet position
- + High-speed loader: **180/200 m/min rapid traverse in X/Y**
- + Only **1.5 m² footprint** with the automation
- + Small contour interference due to loading arm with **integrated double gripper**



1. Stacking magazine 35 kg load capacity per pallet position
2. Double gripper with 2x5 kg load capacity



More about the NLX series can be found at:
nlx.dmgmori.com

**WORLD
PREMIERE
2018**



BMT turret with max. 6,000 rpm and max. 15,9 Nm for machining with driven tools.

ALX-COMPACT TURNING MACHINES:

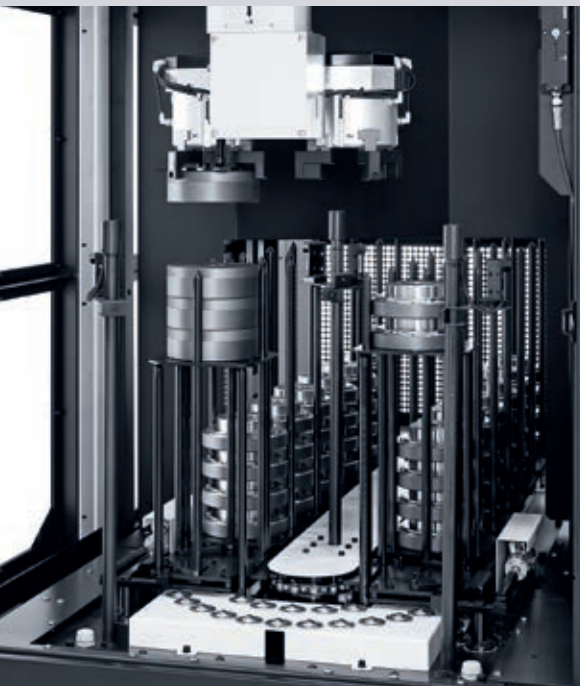
35 EXPANSION OPTIONS FOR
AUTOMATED SERIES PRODUCTION

ALX-SERIES HIGHLIGHTS

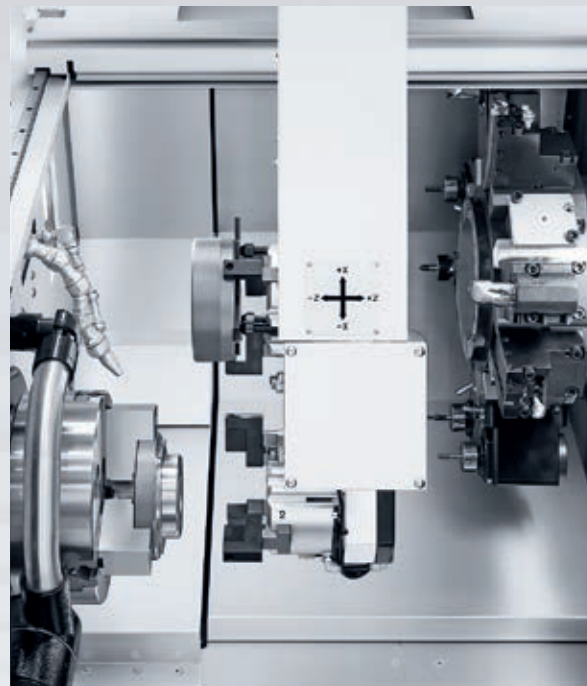
- + **35 expansion options** to meet all production requirements
- + **4 turning length:** 300, 500, 1,000 und 2,000 mm (distance between centres)
- + **turnMASTER Spindles** (Direct Drive) with 0.4 µm concentricity and **36-month warranty** with unlimited hours
- + **Box ways** (X-axis) and **linear guideways** (Y-/Z-axis) for enhanced damping properties and dynamic rigidity
- + **Latest 3D control technology:**
12.1" COMPACTline with MAPPS Pro (300 & 500),
15" SLIMline with MAPPS (1000 & 2000)
- + **11 Technology Cycles** for expanded machining options, e.g. eccentric machining, multi-threading cycle, etc.
- + Energy-saving function **DMG MORI GREENmode**



ALX 2500 with a GX15 gantry loader for workpieces up to $\varnothing 200 \times 150$ mm



Stacking magazine with 10 pallet positions and 75 kg maximum load per position.



Loading arm with integrated double gripper for workpieces up to ø200 mm, 150 mm in length and 15 kg weight.



Inspection station for in-process measurement during production.

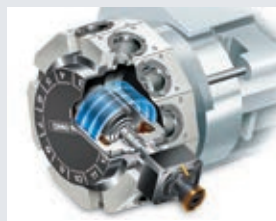
ALX – SUCCESSOR OF THE CL SERIES, OF WHICH 1,000 HAVE BEEN INSTALLED



Footprint comparable to the CL 1500/CL 2000 (300 turning version)

35 EXPANSION OPTIONS WITH 4 TURNING LENGTHS

BMT-turret (MC, Y, SY)
with 6,000 rpm / 5,5 kW / 15.9 Nm (25% DC)

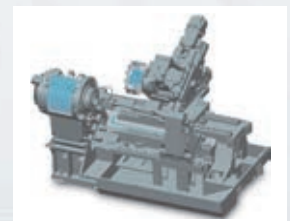


Spindle	Chuck size	Turning length			
		300	500	1000	2000
ALX 1500	6"	•	•	•	•
ALX 2000	8"	•	•	•	•
ALX 2500	10"	–	•	•	•
without tailstock	T		T, MC, Y, SY		T, MC, Y

• available, – not available, T = turning, MC = powered tools, Y = Y-axis, S = counter spindle

Temperature concept

- + Integrated coolant circulation in the machine bed for enhanced thermal stability (300, 500 and 1000 versions)
- + Integrated oil cooling of the turning spindle and BMT turret



Accessibility and maintenance

- Ideal for automation, direct access for daily maintenance from the front, e.g.
- + Tank for oil lubricant and waste oil container
 - + Integrated chip container



turnMASTER spindles

(Direct Drive) with **36-month warranty** with unlimited hours



turnMASTER spindles (10% DC)*			
	Chuck size	Rotational speed	Power / Torque
ALX 1500	6"	6,000 rpm	15 kW / 179 Nm
ALX 2000	8"	4,500 rpm	22 kW / 253 Nm
ALX 2500	10"	3,500 rpm	30 kW / 796 Nm

* Counter spindle 6": 7,000 rpm, 11 kW, 78 Nm (25% DC)

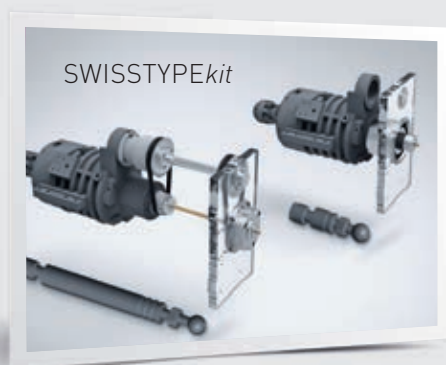
SWISSTYPE^{kit} – SHORT AND LONG PART TURNING ON ONE MACHINE



Marina Zanotti
owner and Managing Director
of O.M.Z. and Pietro Perolini,
joint Managing Director.

SWISSTYPE PACKAGE

- + SPRINT 20 or SPRINT 32 with FANUC 32i control and 10.4" colour display
- + SWISSTYPE^{kit} for short and long part turning on one machine
- + Scraper chip conveyor
- + Equipment for emulsion processing
- + Colour signal lamp
- + Conveyor belt for finished workpieces
- + Transportation packaging
- + Transportation and on site installation



FIXED PRICES* WITH UP TO
23 % DISCOUNT
+ 6 WEEKS DELIVERY

* valid until 31.12.2018

O.M.Z. s.p.a. (Officina Meccanica Zanotti) from Crema in Italy was founded in 1983 and today ranks as a dynamic and efficient contract manufacturer in production turning. Thanks to regular investment in manufacturing technology and equipment, the company has grown to become a reliable partner for well-known customers such as Bosch, Brembo and BTicino. O.M.Z. has been machining its precision turned parts on automatic turning centres from DMG MORI for over 35 years now. There are currently 28 of them on the shop floor, including seven SPRINT 32|8 machines, which were installed over the past two years.

32,000,000 parts, 2,000 tons of material

In view of its large and demanding client base, a customer-oriented approach is essential at O.M.Z. "Most of our work is for the car industry", explains Marina Zanotti. Many components are intended for braking systems, steering wheels and engines. We also have customers in the electronic, gas and hydraulic sectors. Batch sizes range from 200 to several million parts. Around 32 million components leave the factory annually. "That adds up to 2,000 tons of material a year", says the CEO. The parts are made of stainless steels and aluminium alloys, titanium or brass with sizes between $\varnothing 1$ and 72 mm.

One supplier for all processes

All machining processes take place at O.M.Z. Only surface treatment and hardening are outsourced. The company relies on turning machines from DMG MORI to cope with the high throughput. For Pietro Perolini, CEO at O.M.Z. the reasons are obvious: "The quality and reliability of the machines are absolutely impressive." These properties plus excel-

lent service are decisive factors for smooth manufacturing processes with maximum machine availability. The purchase of the seven SPRINT 32|8 machines was also the result of the good relationship the company has established with DMG MORI.

Workpieces up to $\varnothing 32 \times 600$ mm in a footprint of less than 2.8 m²

Designed for complete machining of workpieces up to $\varnothing 32 \times 600$ mm, the SPRINT 32|8 with its compact footprint of just 2.8 m² fits in perfectly on the shop floor at O.M.Z. "The machines offer maximum production capacity in a small space", says Pietro Perolini. The sturdy construction guarantees the required precision: "Widely-spaced ball bearing guideways, the thermosymmetrical machine design and angle encoders in the

SWISSTYPE^{kit} FOR SHORT AND LONG PART TURNING

integrated spindle motor for the main and counter spindles are outstanding equipment features." Capable of holding tolerances of less than 5 μ m, the SPRINT 32|8 offers the highest accuracy in its class.



1. O.M.Z. currently operates 28 automatic turning centres from DMG MORI
 2. The SPRINT 32|8 has a footprint of just 2.8 m²
 3. O.M.Z. boosts productivity with bar feeders

20% shorter set-up times due to the quick tool change system

The machine's high degree of machining flexibility is another decisive feature: "Even complex workpieces can be produced efficiently on the SPRINT 32|8." Such versatility is ensured by the machine's 28 tool stations on two independent linear carriers, six linear axes and two C-axes, plus ten driven tools, two of which are arranged at the front next to the counter spindle. "The capability of the SPRINT 32|8 to machine parts with up to two tools simultaneously reduces throughput times drastically", Pietro Perolini goes on to tell us. The quick tool-change system also cuts set-up times by another 20 percent. The SPRINT 32|8 offers additional machining capability thanks to its SWISSTYPEkit for short and long part turning. Conversion time is less than 30 minutes, including assembly and change of

the control menu. Spindle stroke is extended from 100 mm to 240 mm. Rest piece lengths for long part turning of bar are a minimum of 171 mm and 70 mm for the short part turning configuration. "Thanks to the SWISSTYPEkit, we can machine a multitude of different components on the SPRINT 32|8 and this in turn makes us extremely flexible when processing new orders."

O.M.Z.'s willingness to invest has not disappeared with the purchase of the latest SPRINT models. O.M.Z. also has a number of multi-spindle machines from DMG MORI and Marina Zanotti advises: "We have ordered a new MULTISPRINT 36 and a GM 20 from DMG MORI and are already considering further purchases in this area."

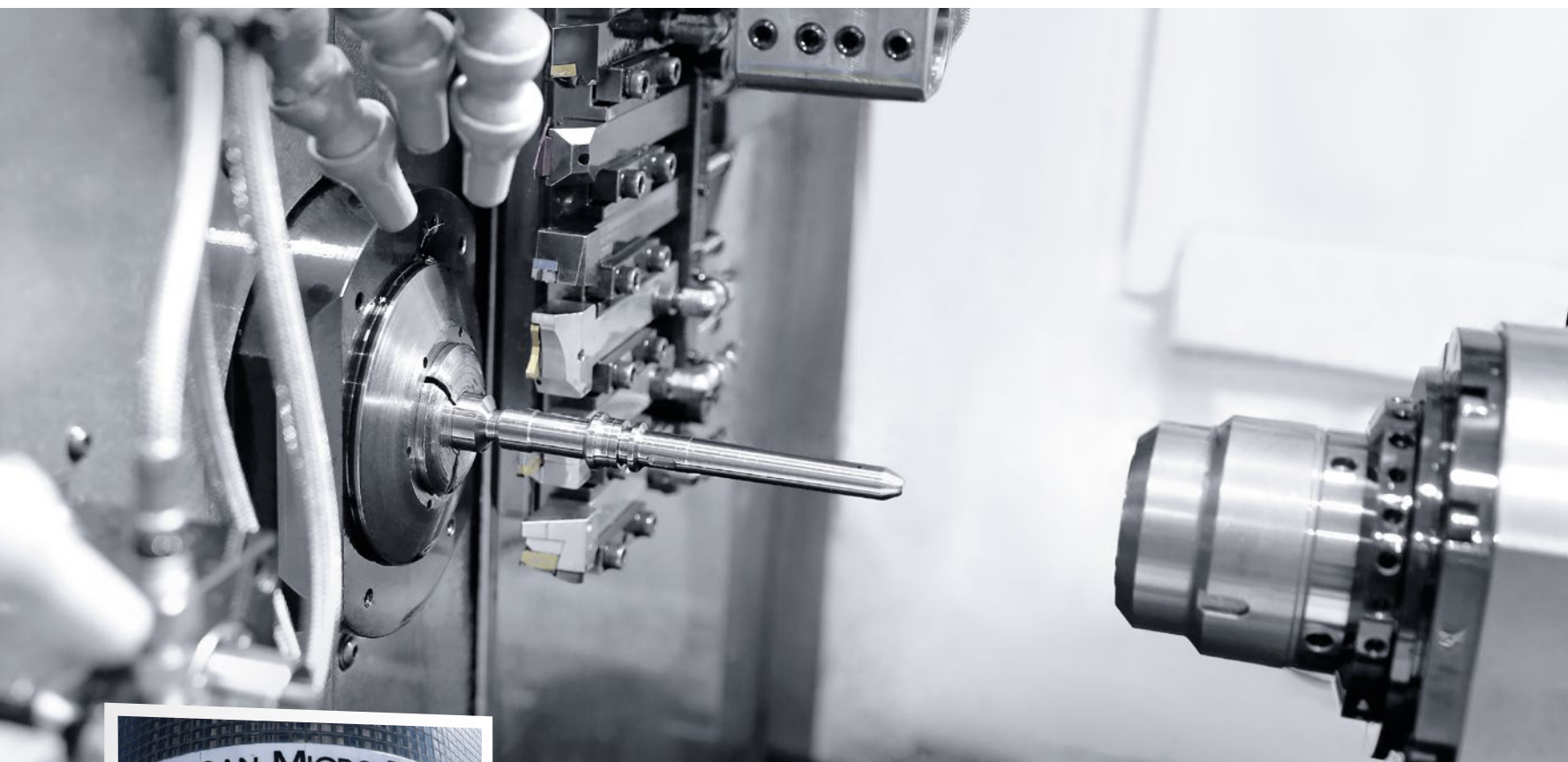
O.M.Z. FACTS

- + Founded in 1983
- + Headquarters in Crema, Italy
- + Precision turned parts for the automotive, electronics and hydraulics sectors



O.M.Z.
 Officina Meccanica Zanotti Spa
 Via Alessandro Volta, 17-23,
 26013 Crema CR, Italy
www.omztorneria.com





Among other things, American Micro Products produces fuel connector on its six SPRINT 32|8 machines.



Federico Veneziano
Chief Operating Officer and
Chief Financial Officer

PRODUCTION TURNING OF COMPLEX GEOMETRIES TO WITHIN MICRONS

American Micro Products maintains its competitive edge in the production of complex precision turned parts using rigidly constructed, high performance turning machines from the SPRINT series.

Over the last 60 years, American Micro Products from Batavia, Ohio has evolved from a one-man job shop to a full service manufacturer that offers its customers integral solutions from a single source. High-precision machining and assembly comprise the focus of the company's service, which it offers to the fluid technology, aerospace, medical devices and engine and fuel systems sectors. Around 200 people are employed at the headquarters and another 100 in a subsidiary in China. Since 2003 the company has relied

for its production on turning machines and compact machining centers from DMG MORI. The installed machines include a number of SPRINT lathes, a few multi-spindle automatic turning machines from the GMC series as well as a MILLTAP 700. The latest purchases, made in 2017, include a SPRINT 32|8 and a SPRINT 50.

"Strategic partnerships with our customers are important for us," stresses Federico Veneziano, Chief Operating Officer at American Micro Products. "Close cooperation helps us to better understand the demanding projects. Being involved in the early phases of development means we can provide support for our customers in an advisory capacity and help with the development of optimum manufac-

turing solutions." The team benefits equally from its many years of experience and from the state-of-the-art CNC equipment in which American Micro Products regularly invests.

24/7 production on automatic lathes from DMG MORI

Federico Veneziano regards innovative and reliable manufacturing equipment as vital for maintaining a competitive edge: "In DMG MORI we have found a supplier that builds advanced and highly productive machines." The availability of the machines is also optimal thanks to the fast response times of its service team. A production stoppage would have far-reaching consequences for American Micro Products, because quantities can be anything up to a million parts per product line,



American Micro Products produces different nozzles on the highly-stable SPRINT 42|10 *linear*.

which in turn can include 100 different variants. The company manufactured these large runs on production turning machines from DMG MORI. Models from the SPRINT series and the GMC multi-spindle automatic turning centres in particular dominate the shop floor. A glance at the range of parts clearly indicates the complicated tasks that the production turning machines from DMG MORI carry out at American Micro Products. Stainless steels and high-strength aerospace alloys are used routinely in production. Accuracy requirements are in the micron range. Thanks to their extensive milling capabilities, both the SPRINT and the GMC models can machine the complex geometries. "We also have very short delivery times that we can only meet with highly productive machines."

Reliable machining of aerospace alloys to micron tolerances

A SPRINT 32|8 is one of the latest production turning machines to be used in production by American Micro Products. The team produces different fuel connectors on this machine. The cycle time for the complex workpieces made from an aerospace alloy is approx. 70 seconds.

The permissible tolerance is just 0.01mm. "A sturdy, high-performance machine is needed for such machining tasks," explains lead operator Dustin Brewer. With its robust and widely-spaced linear guideways, the compact SPRINT 32|8 ensures the necessary rigidity. Federico Veneziano goes on to tell us: "In view of the high complexity of our parts, the versatility of the SPRINT 32|8 was also a key criterion." Virtually all the machine's features are used to produce the workpieces: the main spindle, counter-spindle and the driven tools, up to two of which can be in cut simultaneously. "The combination of stability, performance and flexibility is a decisive factor for ensuring reliable machining processes in the production of complex components made of materials that are difficult to machine." The optimum chip fall in the working area also contributes to high process reliability. He also keeps his sights on the high degree of user-friendliness: "The SWISSTYPEkit enables a changeover time of 30 minutes from short to long parts turning while at the same time offering optimum ergonomics and access to all control features."



SPRINT 32|8

COMPLETE MACHINING OF WORKPIECES UP TO $\varnothing 32 \times 600$ mm IN A FOOTPRINT OF LESS THAN 2.8 m²

HIGHLIGHTS

- + 6 linear axes and 2 C-axes
- + 28 tool stations on two independent linear carriers
- + Up to 10 driven tools, (4/4/2 – slides 1/2/3)
- + Up to 2 driven tools in operation at the same time
- + Permanent rigidity thanks to robust, widely spaced ball-bearing guides
- + Optional SWISSTYPEkit for short and long turning operations on a single machine



Tool Lifecycle Management supports Industry 4.0

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Operator Erica Williams working on the SPRINT 50. The production turning machine enables automatic bar machining and turning of chuck parts with up to 36 tool stations.

Two separate work areas thanks to the patented TWIN concept

While the SPRINT 32|8 produces workpieces ordered by customers, American Micro Products uses the SPRINT 50 for a product it has developed itself, an hermetically sealed electric connector. The turret machine in the SPRINT series scores here with its robust design, which derives from its thermally

ROBUST DESIGN FOR MAXIMUM PRECISION

stable and inherently rigid machine bed with its 3-point support. The liquid-cooled main and counter spindles guarantee maximum precision. "These workpieces also have maximum accuracy requirements", says Federico Veneziano. Free chip fall into the vertical machine bed ensures a high level of process reliability. The patented TWIN concept of the SPRINT 50, which has been proven a thousand-times over, ensures maximum productivity: two separate work areas are created through the machine's two turrets and the cross travel of the counter-spindle/tailstock combination. Investments in modern production equipment such as the SPRINT machines

ensure we maintain our competitive edge," claims Federico Veneziano. That is why he intends to continue with this strategy: "We have seen a few bad years, but the economic situation has now picked up enormously, so our order situation will certainly entail further investments."

«

AMERICAN MICRO FACTS

- + 200 employees at its headquarters in Batavia, Ohio
- + Chinese subsidiary with 100 employees
- + 60 years of experience in precision machining for fluid control, aerospace, medical devices and engine and fuel systems
- + Strategic partnerships with customers early on in the development phase



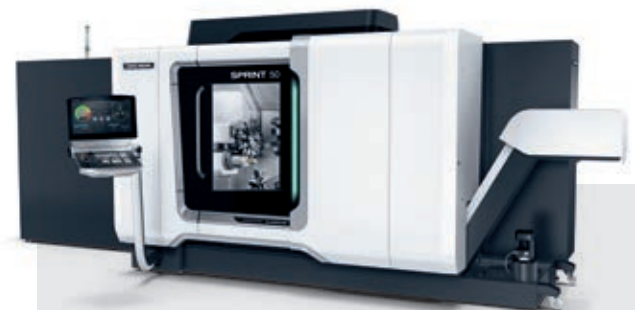
American Micro Products, Inc.
4288 Armstrong Blvd.
Batavia, OH 45103-1600
www.american-micro.com



“Modern machines like the SPRINT 32|8 und SPRINT 50 ensure we maintain our competitive edge.”

Federico Veneziano

Chief Operating Officer and Chief Financial Officer of American Micro Products Inc.



SPRINT 50

4-AXIS PRODUCTION TURNING WITH UP TO 36 DRIVEN TOOLS FOR MAX. ø 50 mm

HIGHLIGHTS

- + **CELOS with SIEMENS:**
2 turrets and TWIN-concept, 3 turrets and 3 turrets with B-axis
- + **CELOS with FANUC on MAPPS:**
2 turrets
- + **Free chip flow** thanks to vertical machine bed, no thermal impact
- + Liquid-cooled main and counter spindles guarantee **maximum precision**



Tool in cut

Vibration and surface roughness

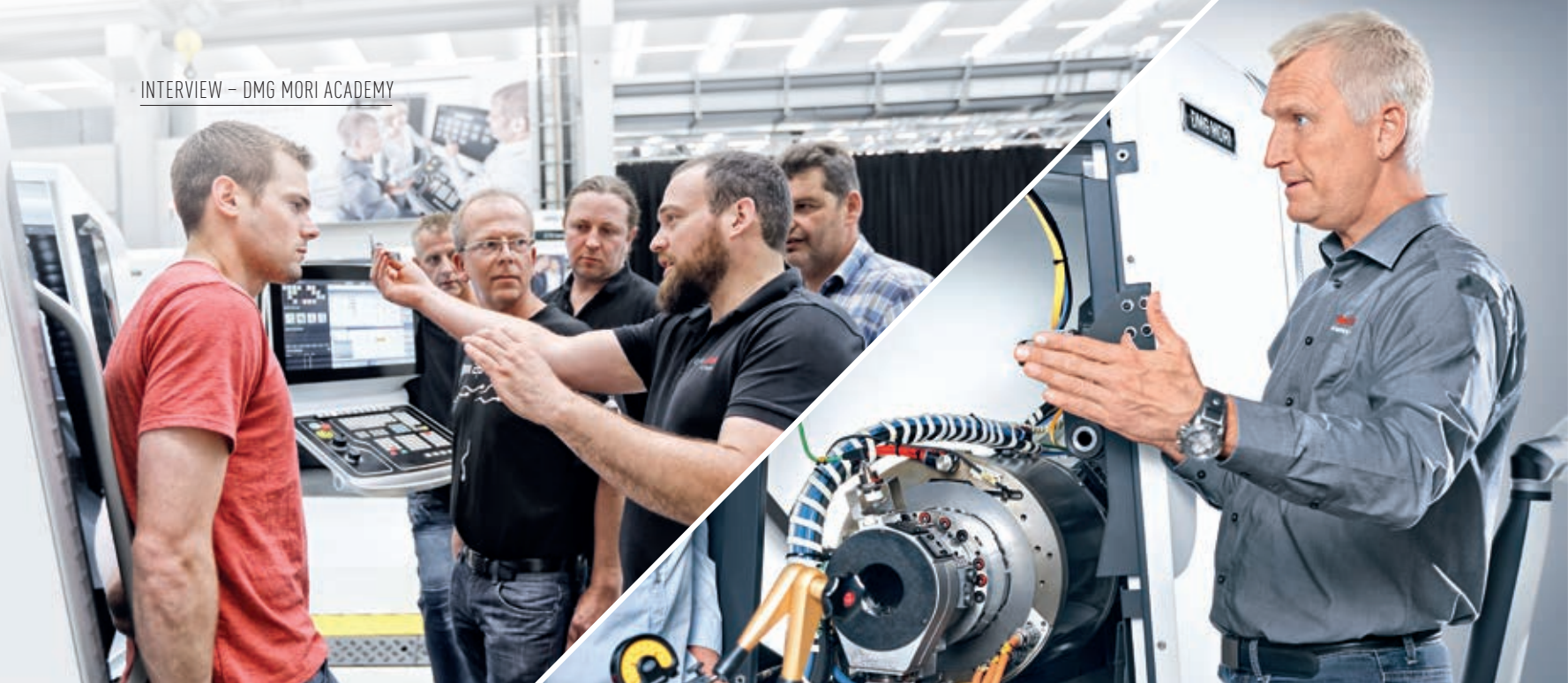
Damper temperature

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“YOUR **NO. 1** FOR TRAINING AND PROFESSIONAL DEVELOPMENT”



Jan Möllenhoff
Managing Director of the
DMG MORI Academy
jan.moellenhoff@dmgmori.com

For over 25 years, the DMG MORI Academy has been imparting manufacturing know-how at 13 locations worldwide. Modular training courses for customers and service technicians, professional qualifications and cooperations with educational institutions are all just as much a part of the offer as involvement in the WorldSkills competition and – as the latest addition – advice from the newly founded Additive Manufacturing Excellence Centre. Jan Möllenhoff, Managing Director of the DMG MORI Academy, talks about the development of the world's largest CNC Academy and its relevance within the Group.

Mr Möllenhoff, what place does the DMG MORI Academy take in the DMG MORI portfolio of products and services?

The latest CNC machines in particular demand a high level of know-how if the potential of manufacturing solutions is to be exploited to the full. And that is exactly where we come in with our modular course offer. We train our customers in the basics of programming, set-up and operation of our machines. Additional training is given in our advanced courses, for example in the fields of measuring probes or plane transformation. Professional courses focussing on complex mill-turn, turn-mill or 5-axis simultaneous machining round off the offer.

We also offer service training courses. The great majority of participants on the service training courses – 80 percent – are our

own DMG MORI service engineers, but we also train employees of our customers. We offer a compact 2-day course for aligning a machine after a collision, for example. The knowledge transferred in the service courses often enables the customer's own maintenance department to carry out most of the service and maintenance tasks. The resulting time advantage, of course, boosts machine availability.

How did the offering from DMG MORI Academy develop from classic training courses?

We started early on with transferring our knowledge as skills training to publicly funded jobseekers. Our personnel department helps to place those who successfully complete a course with DMG MORI customers. Over 85 percent of the jobseekers with this qualification secure a position.



You also combat the skills shortage with such training ...

Yes, exactly. We have 18 employees worldwide whose sole task it is to consult educational institutions and trainers in industrial companies about the equipment and concepts of modern CNC training. This topic is gaining in importance not only in Europe, but in particular in emerging countries such as Russia, China and India. We offer entire turnkey solutions to vocational schools, technical

colleges or universities as well as industrial educational institutions. These solutions include machine tools and innovative programming software plus teaching aids and train-the-trainer seminars.

How do educational institutions benefit from such turnkey solutions?

As a leader of technology, DMG MORI ensures future-oriented training with these projects. Special training packages for areas of Industry 4.0 and digitisation of training are good examples.

Your activities worldwide indicate that promoting young talent is a global exercise. That fits in well with your involvement in the WorldSkills competition ...

Absolutely. We have long supported both WorldSkills Germany and WorldSkills International – the latter as a Global Industry Partner since 2016. We plan to equip the next

WorldSkills competition that will be taking place in Kazan (Russia) in 2019 with our CNC turn and mill machines and to provide technical support as we did last time in Abu Dhabi (UAE) in 2017.

You are entering a new technological field with your work in the Additive Manufacturing Excellence Centre. What tasks have been assigned to the DMG MORI Academy?

Additive manufacturing with powder nozzle or powder bed technology opens up completely new design options and so, of course, great opportunities for innovative solutions. Although many users recognise the potential of this technology, they often do not have the necessary knowledge. We see it as our task to develop the necessary design expertise at our customers and to establish the process chains for the LASERTEC 3D/3D hybrid and LASERTEC SLM series. The "AM Quick Check" is the starting point where we identify specific potential together with our customers. Next we help with the engineering of components and can take on the production of small series. We also offer further advice on the introduction of technologies as well as training in management, design and manufacturing.

«

THE WORLD'S LARGEST CNC ACADEMY!



The DMG MORI Academy has over 20,000 participants a year on courses at 13 academy locations worldwide plus additional trainees on-site at customers' premises.



You will find all contacts/ addresses at:
locations.dmgmori.com

ACADEMY FACTS

- + 13 high-tech training centres worldwide
- + Over 20,000 course participants a year
- + Modular training offer with >200 courses
- + 85 modern DMG MORI machines for training
- + 62 classrooms
- + More than 2,500 educational institutions equipped with DMG MORI machines

DMG MORI

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ADDITIVE MANUFACTURING WITH POWDER BED AND POWDER NOZZLE FROM A SINGLE SOURCE

CONFORMAL COOLING CHANNELS

Optimum angle of the coolant jet
to the point of cutting

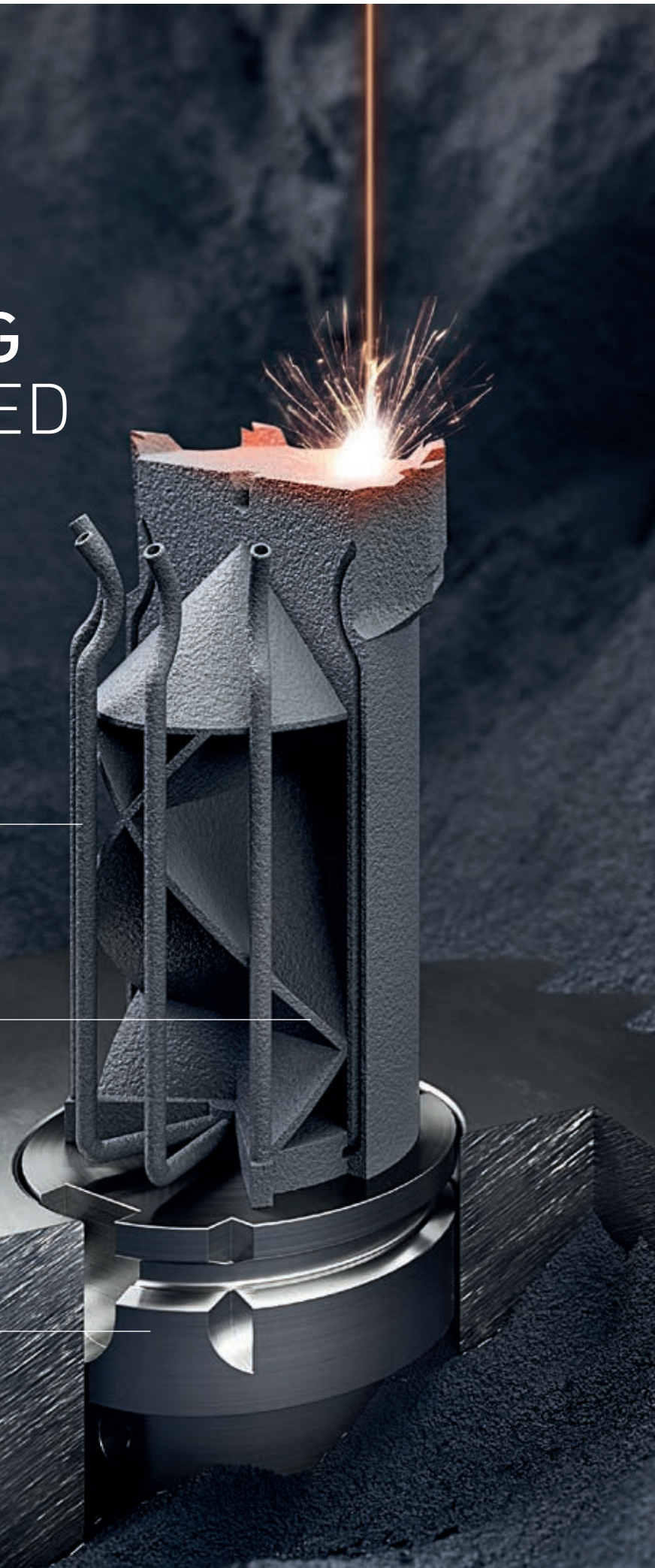
LIGHTWEIGHT DESIGN

30% reduction in weight with
the same torsional stiffness

DIRECTLY TO THE FINISHED PRODUCT

Build process on an HSK holder does away
with the need for support structures

Cannot be achieved conventionally:
Function integration and lightweight
structures ensure shorter cycle times



Customised manufacturing solutions: As a supplier of all types of additive manufacturing system for producing metal parts, DMG MORI combines its LASERTEC 3D hybrid, LASERTEC 3D and LASERTEC SLM models with conventional CNC machines.

Decades of experience in machine tool construction, laser technology and powder bed technology make DMG MORI a global supplier of all types of equipment for additive manufacturing of metal parts. Experts at the

ADDITIVE MANUFACTURING EXCELLENCE CENTRES use their extensive expertise to develop manufacturing solutions for customised applications and to train customers in the handling of the innovative technologies. Competence in this field is also incorporated into the continuous development of additive manufacturing. This has resulted in four process chains linked with the LASERTEC 3D hybrid, LASERTEC 3D and LASERTEC SLM series. In combination with conventional CNC machines, DMG MORI offers holistic solutions for additive complete production.

LASERTEC 3D hybrid: Additive manufacturing using a powder nozzle and conventional machining in a single set-up
DMG MORI has marketed the LASERTEC 65 3D hybrid for five years. The machine combines Laser Deposition Welding and 5-axis simultaneous milling in a single set-up. The larger turn-mill centre LASERTEC 4300 3D hybrid works on the same principle. Alternate build-up and milling or turning of parts is possible. This capability enables the production of extremely complex geometries, as areas

FOUR PROCESS CHAINS FOR ADDITIVE COMPLETE MACHINING



GLOBAL SUPPLIER OF A FULL RANGE OF ADDITIVE MANUFACTURING SOLUTIONS

- + **Unique:** Four process chains in ADDITIVE MANUFACTURING and finishing by metal cutting from a single source
- + **20 years' experience** in laser technology and SLM technology
- + **End-to-end competence** in the field of additive metal machining
- + **Powder bed (SLM) and powder nozzle (LDW)** under one roof for all metallic materials and geometries
- + **LASERTEC 3D hybrid/ LASERTEC 3D:** Success on the market with laser deposition welding using the powder nozzle technique
- + **LASERTEC SLM:** Pioneer in powder bed technology
- + **Comprehensive consulting services and training** e. g. for design, material selection and the definition of process parameters

are machined during processing that are no longer accessible after further manufacturing steps.

LASERTEC 65 3D: The right addition to machines already installed on the shop floor

The compact LASERTEC 65 3D is a 5-axis machine developed just for laser deposition welding with a powder nozzle. Finishing is carried out on external milling machines, ensuring optimum exploitation of production capacity. The work area of the LASERTEC 65 3D is about 40 percent larger than the hybrid version and its footprint is about 45 percent smaller. DMG MORI offers the complete process chain, from NC programming through to post-processing on the machines. DMG MORI completes both process routes, from programming in hybrid CAD/CAM with SIEMENS using technology parameters from a material database, through to machining, process monitoring and documentation.

LASERTEC 30 SLM: Two process chains with powder bed additive manufacturing
DMG MORI offers the LASERTEC 30 SLM for additive manufacturing using the powder bed process (Selective Laser Melting). The second generation of the machine has a 300×300×300 mm build volume and with its Stealth design offers optimum user convenience. Two process chains enable powder bed technology. Workpieces produced by means of additive manufacturing can be finished to the required surface quality on a milling machine. In addition, the LASERTEC 30 SLM can finish by additive manufacturing previously milled base plates and bodies, without any need for support structures.

The integral software solution for CAM programming and machine control, CELOS, rounds off the process chains with the LASERTEC 30 SLM. Thanks to the efficient flow of information and intuitive operation, this uniform interface ensures optimum processes in the pre- and post-processing of additively manufactured parts.

«

LASERTEC 30 SLM
2nd Generation



rePLUG powder module system for material exchange < 2 hours.

HIGHLIGHTS

- + Powder bed with 300×300×300 mm build volume
- + CELOS: Integral software solution from CAM programming through to machine control
- + Open system: Individual adjustment of all machine settings and process parameters as well as unrestricted selection of material suppliers

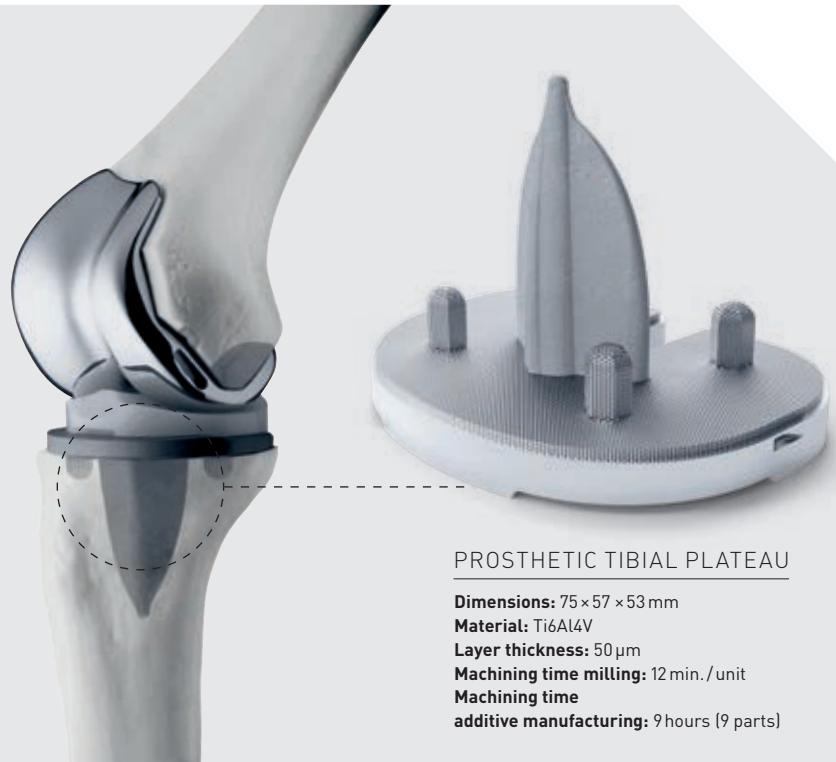
- + One material per rePLUG – expansion of the material range thanks to modular changing system
- + Safe powder handling thanks to integrated peripherals including powder recycling
- + High level of process autonomy: powerful duo filter system with automatic changeover
- + Optional: rePLUG RESEARCH for material and process parameter development for series production

MILLING → ADDITIVE MANUFACTURING

DIRECTLY TO THE
FINISHED PART IN
THE POWDER BED!

Milling of base plate and body before the additive manufacturing process makes support structures unnecessary and leads directly to the finished part!

«



PROSTHETIC TIBIAL PLATEAU

Dimensions: 75 × 57 × 53 mm
Material: Ti6Al4V
Layer thickness: 50 µm
Machining time milling: 12 min./unit
Machining time additive manufacturing: 9 hours (9 parts)



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INNOVATIVE PRODUCT AND PRODUCTION OPTIMISATION WITH POWDER BED TECHNOLOGY

NHW 3D, a competence centre for additive processes with a team of three staff, optimises production processes for customers from the automotive, aerospace and mechanical engineering sectors and develops customised solutions from the idea to prototype manufacture and on through to preparation for series production. After extensive field trials in cooperation with DMG MORI, NHW 3D has now expanded its capabilities and capacity in metal laser melting with the procurement of a LASERTEC 30 *SLM* 2nd Generation.



NHW 3D optimises the components of its customers with innovative ideas.



Around 30% lighter tools thanks to SLM technology

“3D printing is an efficient solution for the production of complex components”, is how Michael Schmid, CEO of NHW 3D explains the core competence of his company. In particular, the additive manufacture of metal components is growing in importance. The example of a milling cutter, which NHW 3D produces

rePLUG – THE POWDER MODULE FOR MATERIAL CHANGE IN LESS THAN TWO HOURS

for the Neher Group, illustrates the benefits of additive production. The cutter is built up on an HSK holder of hot work steel. A sturdy support structure in the interior of the cutter ensures the necessary torsional stiffness.

“The result is a 700 g tool that is 30 percent lighter, but still has the same degree of stability”, says Michael Schmid. “Added to this are filigree and conformal cooling channels that we arrange in such a way that the jet of coolant hits the cutting edge at the ideal angle.” Michael Schmid sees big advantages in the additive approach: “We can achieve great savings potential with 3D printing, while shorter development times offer greater flexibility in the product development process. It also complements conventional process chains.” In many cases, design, programming and complex milling operations can be more time and cost-intensive than additive manufacturing.

Win-win situation:

Process reliability and maximum availability thanks to joint development

The aim of NHW 3D, which has grown significantly since its foundation, is to intensively support the development of manufacturing technologies. This has led to close cooperation with DMG MORI in the joint development of the latest generation of LASERTEC 30 *SLM* machines as part of a field test programme. “We can draw on an extensive range of manufacturing technologies at HFM and the Neher Group was also a development partner of DMG MORI in the past”, recalls Michael Schmid about the cooperation. The practical

The LASERTEC 30 *SLM* 2nd Generation allows us to optimise existing manufacturing processes intelligently with innovative ideas.



Michael Schmid, Managing Director NHW 3D
Isabel Koschmieder, technical model maker and
Christian Bender, also a technical model maker and responsible for sales

results of the development partnership have made a lasting impression on NHW 3D. The big advantages of the LASERTEC 30 *SLM* are its compact design and fast powder change-over. DMG MORI calls the modular system rePLUG. "Replacing the powder module takes less than two hours", says Isabel Koschmieder, technical model maker at NHW 3D. rePLUG also contributes to safety at work: "The closed material circuit means that the potentially reactive powder cannot escape and be inhaled."

High process autonomy with powerful duo-filter system

With regard to the filter system, DMG MORI has also taken the question of process reliability

into consideration in the LASERTEC 30 *SLM* 2nd Generation, as Christian Bender, responsible for additive technologies and sales at NHW 3D, explains: "The machine has a powerful duo-filter system that automatically alternates the filters so they can be changed without interrupting the process. This boosts machine availability significantly, especially at night and weekends."

Open system: Individual adjustment of all machine settings and process parameters

The LASERTEC 30 *SLM* 2nd Generation is equipped with the uniform control and user interface CELOS. "The machine is a completely open system. In other words, all settings and process parameters can be

adjusted individually", says Christian Bender, giving us an insight into the day-to-day use of the machine. This ensures flexibility in production as well as an unlimited choice of material suppliers. "Such freedoms mean we can be extremely customer-oriented in our work", Michael Schmid goes on to tell us. "Our aim is to optimise production processes intelligently with innovative ideas and to print perfect components. The LASERTEC 30 *SLM* 2nd Generation plays a key role here."

«



The LASERTEC 30 *SLM* 2nd Generation is equipped with the uniform control and user interface, CELOS.

NHW 3D GMBH FACTS

- + Founded in Ostrach in 2016 as a subsidiary of the model and mould making company HFM, of the Neher Group, a manufacturer of precision tools, and of w3 GmbH, a media service provider
- + Competence centre for additive manufacturing
- + Plastic laser sintering, stereolithography and metal laser melting

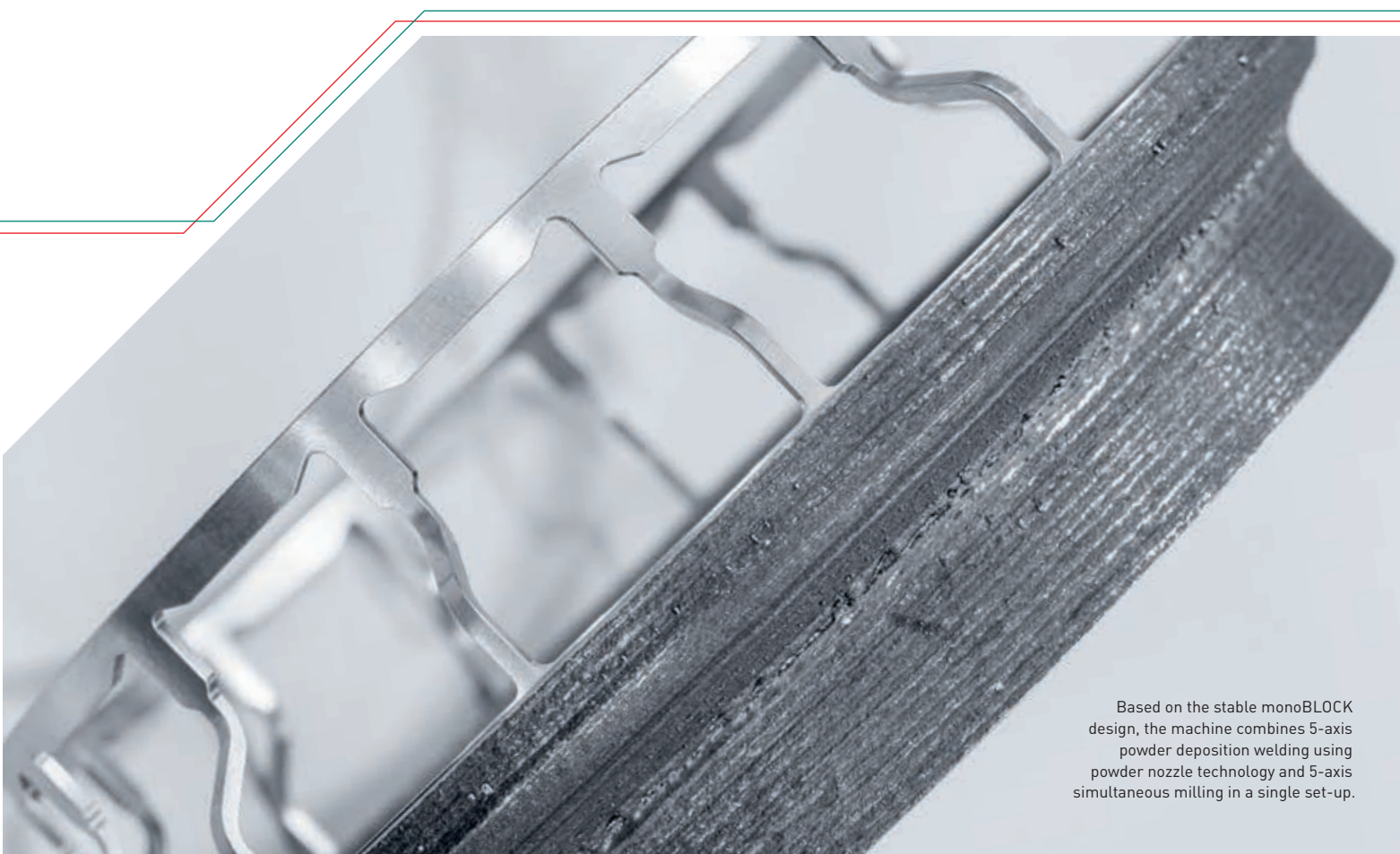


NHW 3D

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 Germany
www.nhw3d.de



COST-EFFICIENT PROCESSES THANKS TO HYBRID COMPLETE MANUFACTURING USING A POWDER NOZZLE



Based on the stable monoBLOCK design, the machine combines 5-axis powder deposition welding using powder nozzle technology and 5-axis simultaneous milling in a single set-up.

With over 90,000 employees worldwide, around 170 locations in more than 50 countries and 18 R&D centres, Schaeffler ranks as one of the most innovative technology companies not only in car manufacturing, but in a multitude of other industrial sectors as well. Additive manufacturing (AM) is one of the technologies used in the production of tools, prototypes and assembly fixtures. A dedicated AM fabrication shop at the Herzogenaurach site develops future-oriented solutions that result in stable processes and optimised products. Schaeffler has been using a

LASERTEC 65 *3D hybrid* from DMG MORI for 3D printing of metal components by powder deposition welding since 2017.

Multiple materials/Graduated Materials

As a company driven by innovation, Schaeffler is permanently on the look-out for ground-breaking solutions to optimise its own manufacturing processes and the products of its customers. The efficient use of new technologies enables substantial rationalisation in tool making, for example. "Metallic 3D printing is taking on an ever greater role in this respect", explains

Carsten Merklein, Head of Additive Manufacturing Corporate Tool Management & Prototyping. Creative projects in the AM fabrication shop are aimed at advancing the development of additive processes.

Additive manufacturing as part of the overall process

Since 2017, the LASERTEC 65 *3D hybrid* from DMG MORI has been one of the machines at the heart of this development work. "5-axis powder deposition welding using powder nozzle technology combined with 5-axis simul-



We can give components new material properties with the LASERTEC 65 3D hybrid.

Carsten Merklein
Head of Additive Manufacturing
Corporate Tool Management & Prototyping
at Schaeffler



taneous milling in a single set-up offers completely new freedoms in design”, says Udo Ringler, Team Coordinator in the AM fabrication shop. “We use the powder nozzle, for example, to re-build material that has broken off a used workpiece and then mill it to restore the part to its original state.” Such a repair is sometimes cheaper and faster than producing a spare part conventionally.

“The LASERTEC 65 3D hybrid opens the way to completely new properties, such as hardness gradients in the workpiece or multi-material components.”

Carsten Merklein takes a tool base frame for a press to illustrate the economic efficiency of the process: “Milled sheet material made of hot-worked steel serves as the base upon which the LASERTEC 65 3D hybrid builds up two columns, which are then milled”. The challenge here lay in the behaviour of the base when subjected to the heat of the laser beam and in the strength of the finished part. “Originally we milled the workpiece completely from a blank.” Such blanks were both more difficult to procure than the sheet material and meant significantly higher material usage.

However, the ability of the LASERTEC 65 3D hybrid to deposit different materials in the build process opens up additional possibilities for Schaeffler, as Carsten Merklein goes on to explain: “It enables us to add materials with different properties to the parts – exactly

where they are needed.” This optimises workpieces with regard to strength, wear and lubrication properties, for example.

Promoting future applications with 3D printing

The development of the different uses of additive processes is a driving force at Schaeffler, including for products used in car manufacture and industry in general: “If you consider electromobility or other issues of the future, then lightweight design is a key factor that we intend to help shape with intelligent ideas in 3D printing.”

«

SCHAEFFLER FACTS

- + Over 90,000 employees worldwide
- + Around 170 locations and 18 R&D centres
- + A fabrication shop in Herzogenaurach for creative projects in 3D printing

SCHAEFFLER

Schaeffler Technologies AG & Co. KG
Industriestraße 1-3
91074 Herzogenaurach
Germany
www.schaeffler.com



Alternating between laser deposition welding and milling enables the production of highly complex components and the repair of defective workpieces.



Since 2017, Schaeffler has used a LASERTEC 65 3D hybrid in its fabrication shop.

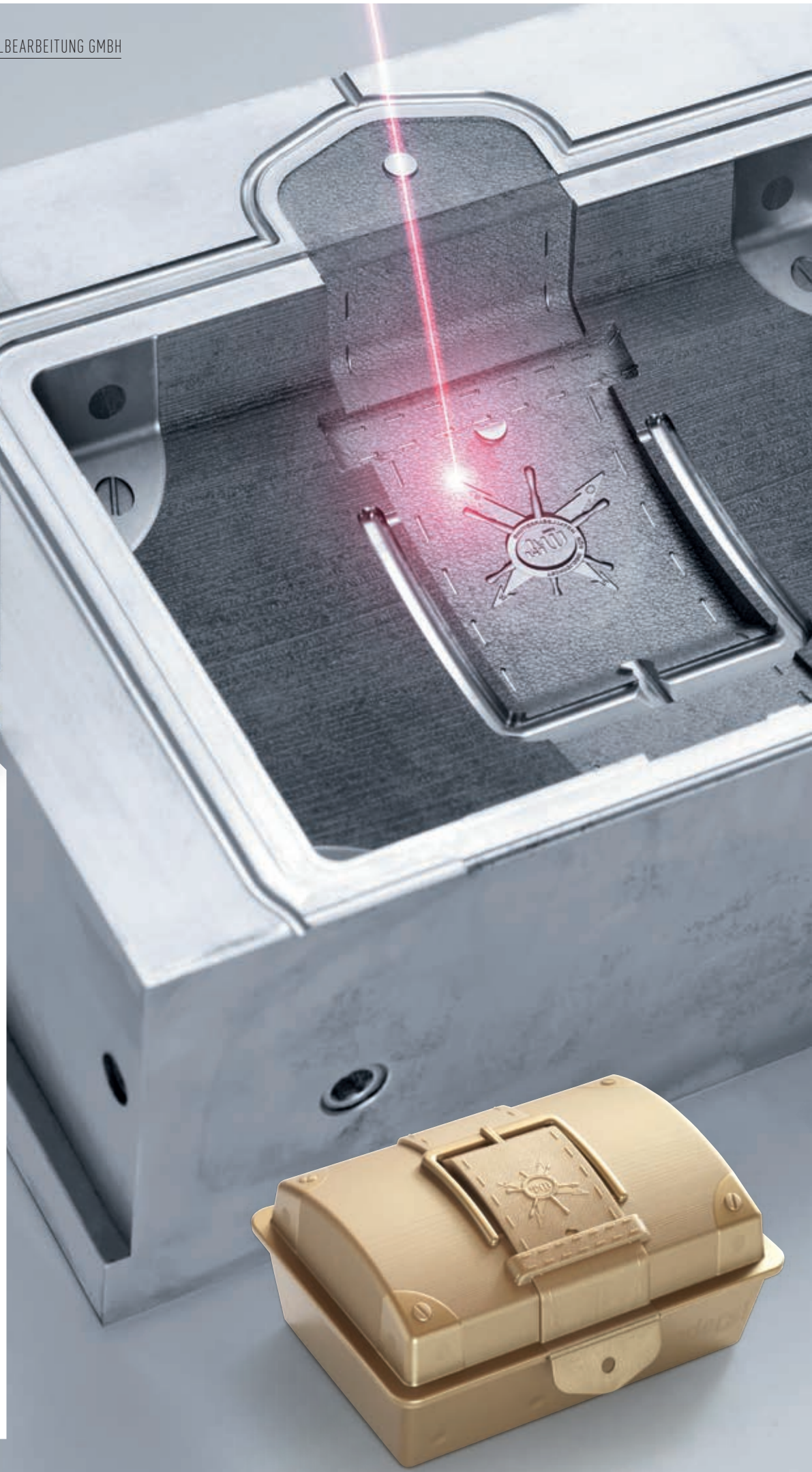


LASERTEC 75 SHAPE

INDIVIDUAL AND REPRODUCIBLE TEXTURES EVEN ON THREE-DIMENSIONAL FREE-FORM SURFACES

HIGHLIGHTS

- + **Excellent repeatability** and reproducibility
- + **Different fibre lasers** for widely differing applications
- + **Surface structures** without environmentally damaging etching
- + **Integrated NC swivelling rotary table** (workpieces up to $\varnothing 840 \times 520$ mm / 1,000 kg)
- + **High stability and long-term accuracy**, cooled drives and linear scales in all axes





LASER TEXTURING AS AN INVESTMENT IN THE FUTURE

Customised surfaces and absolute reproducibility: TFM is the first company in Austria to use a LASERTEC 75 Shape from DMG MORI for tool and mould making.

Expert personnel and innovative manufacturing technologies have been supporting pillars in the business success of TFM Technologie für Metallbearbeitung GmbH since it was founded in 1996. With a comprehensive range of services from design to the final acceptance of sophisticated tools and moulds, TFM stands shoulder to shoulder with its customers. They come from widely differing sectors, from the toy industry and consumer electronics to the packaging industry and car manufacturing. With the LASERTEC 75 Shape from DMG MORI, the company has taken a step into the future of manufacturing. It enables the individual laser texturing of 3D free-form surfaces and therefore provides almost limitless freedom in the design of tools and moulds.

Increasing quality requirements and short delivery times determine day-to-day business in the tool and mould making industry. "We respond to this with continuous process optimisation," explains Corinna Lindinger, Director of TFM and daughter of the company founder, Günther Lindinger. The company therefore puts existing technologies to the test and keeps a lookout for new machining methods. "Such

was the case with the LASERTEC 75 Shape," recalls Michael Reitberger, responsible for sales and technical management at TFM.

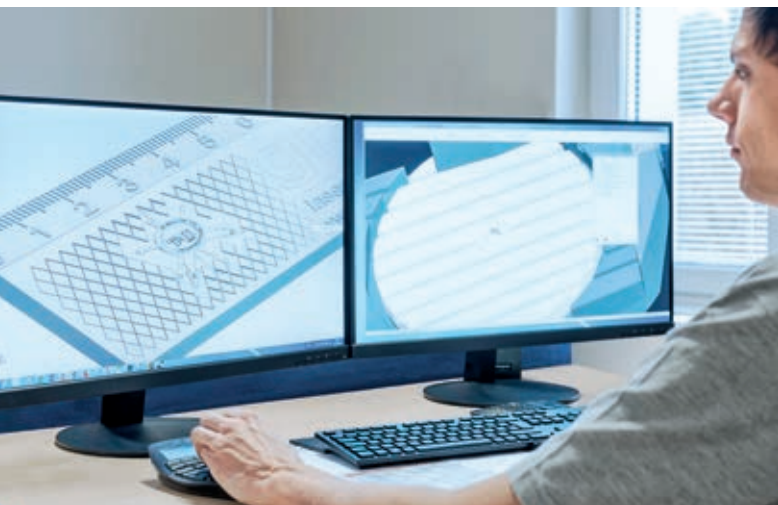
LIMITLESS FREEDOM OF DESIGN WITH LASER TEXTURING

Optimising processes by laser texturing

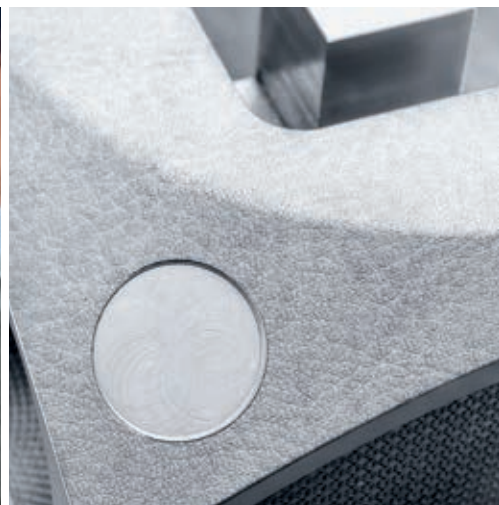
For TFM, laser texturing was an important step in optimising in-house processes and expanding the range of services. "We were the first Austrian company to offer this technology and we see great potential for the future," says Corinna Lindinger optimistically. Compared with conventional processes, laser texturing is clearly superior in many instances. "Electrode production and erosion are process steps that we can save thanks to the LASERTEC 75 Shape and it significantly reduces our throughput times," explains Michael Reitberger. This increases flexibility in production and enables faster delivery. "A further argument in favour of the DMG MORI machine is the large work area". »

Compared to conventional processes, laser texturing is clearly superior in many cases.

Corinna Lindinger
Managing Director
of TFM GmbH



With an holistic philosophy, TFM supports its customers from the design to the finished component.



Compared with conventional processes, laser texturing is clearly superior in many cases as process steps such as erosion and etching can be eliminated.



In 2017, TFM expanded its range of services with laser texturing on a LASERTEC 75 Shape.

With travel distances of 750×650×560 mm (X/Y/Z) and a table load capacity of up to 600 kg, TFM is also able to texture large workpieces efficiently.

Individual designs and absolute reproducibility

The texture of the mould surfaces gives the finished products their unique look and feel. Laser texturing scores twofold compared with conventional etching. On one hand, designers have a great degree of design freedom and can create individual textures on the PC. On the other, these textures can be reproduced with absolute repeatability at any time. "Everything is based on a continuous, digital process chain – from the concept to the finished plastic part," adds Michael Reitberger. The company also benefits from the extremely sharp contours achieved with laser machining.

Ensuring competitiveness

Corinna Lindinger believes that advanced training, as in the case of laser texturing, and also the training of the next generation of employees, will make a significant contribution to strengthening the company: "On one hand, a great deal of expertise is required to make full use of the potential of modern manufacturing technologies. On the other, it is becoming more and more difficult to find good, skilled staff".

The LASERTEC 75 Shape has quickly shown where its strengths lie. According to Michael Reitberger, TFM intends to build on these: "Both existing and new customers will benefit from more efficient processes and totally new design possibilities."



Benjamin Krummenauer
Product Manager LASERTEC Shape
SAUER GmbH
benjamin.krummenauer@dmgmori.com

	LASERTEC 45 Shape	LASERTEC 50 Shape	LASERTEC 75 Shape	LASERTEC 125 Shape	LASERTEC 210 Shape
Workpiece measurements mm					



Photo:
TFM Technologie GmbH

The LASERTEC 75 Shape is part of our continuous process of optimisation for the die and mould sector.

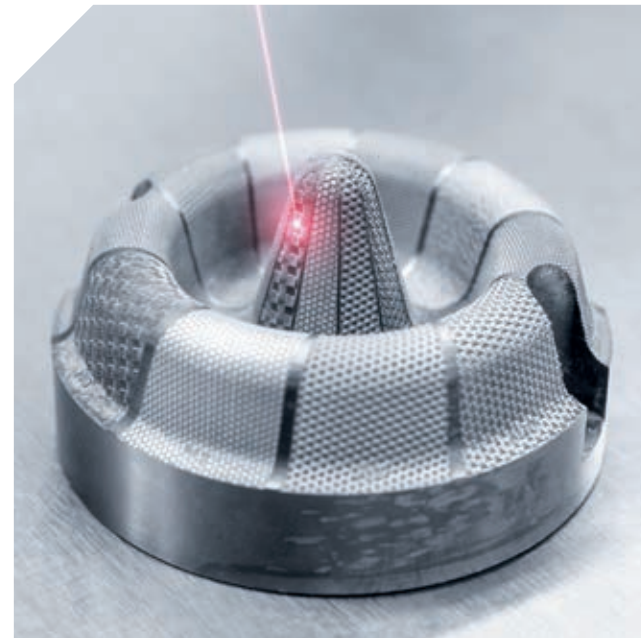
Corinna Lindinger
Director of TFM and
Michael Reitberger
responsible for sales and
technical management.

TFM FACTS

- + 30 employees in Traun
- + Broad customer base from consumer electronics to car manufacturing
- + Comprehensive service portfolio from design to final acceptance



TFM – Technologie für
Metallbearbeitung GmbH
Ganglgutstraße 87b
4050 Traun, Austria
www.tfm.at
www.lasertexturieren.at



LASERTEC SHAPE

FILIGREE SURFACE STRUCTURES – PRECISE, FAST AND REPRODUCIBLE

- + Unlimited possibilities for the design of individual structures (cosmetic and technical)
- + Environmentally friendly, reproducible and an alternative process to conventional etching technology
- + Latest scanner technology with scan speeds up to 30 m/s
 - Reduce process time by up to 69% for lower cost per part
 - Improved texture quality at high process speeds for filigree structures
- + Holistic process control using a control panel with CELOS and integrated LASERSOFT 3D APP; from greyscale bitmap to finished textured part (not for LASERTEC 45 Shape)
- + LASERTEC 45 Shape for workpieces up to \varnothing 320 mm in a footprint of less than 3.7 m², or up to \varnothing 2,100 mm and 10 t weight on the LASERTEC 210 Shape



More about the LASERTEC series can be found at:
lasertec-shape.dmgmori.com

UP TO 70% FASTER JOB TURNAROUND

Many companies claim to be world class. Weber Manufacturing Technologies Inc. puts its money where its mouth is. So when president Chris Edwards and his team found themselves faced with a continually increasing demand for larger moulds and shorter lead-times, they turned to machine tool builder DMG MORI. Again. The DMU 340 P 5-axis machining centre boasts 3,400 mm (134 in.) of X and Y axis travel, a 2,600 mm (102 in.) table, and a whopping 20,000 kg (35,715 lbs.) capacity. It's the largest DMU-style machining centre in all of Ontario. Weber also purchased a DMC 85 monoBLOCK machine with three pallets, with another DMC on the way. When asked, "Why another DMG MORI?", Edwards made no bones about his decision. "They're still considered the Cadillac of the machining world."

Machining of very large, very complex moulds and other tooling is Weber's core competence. 99.8 per cent nickel is the material used to manufacture many of those products. "Our niche is the design and production of nickel tooling using a unique process called NVD

3,400 mm TRAVEL
IN X AND Y AND
20,000 kg CAPACITY

(nickel vapour deposition)," vice president of operations Brent Hale says. "We're the only manufacturer in the world doing it this way on a large scale commercial basis."

Manufacturing large nickel moulds to tolerances of a hundredth of a millimetre

It's at least partly due to Weber's success with high-performance nickel tooling that its management has been pushed to further expand its machining capabilities with the new DMG MORI machines. Yet the tool manufacturer also machines large quantities of Invar, steel, aluminium and plastic, and it was the rigidity needed to remove massive amounts of material together with the tooling's extreme accuracy requirements that led them to DMG MORI. "We might hold ± 0.05 mm (0.002 in.) on a block of metal measuring 1,500 x 2,400 mm (5 x 8 ft.) across, which is awfully tight for a workpiece that large," Hale explains. "That, together with the need to meet increasingly stringent customer demands, is what led us to this investment in new machine tool technology."

Higher kinematic precision with DMG MORI Technology Cycles

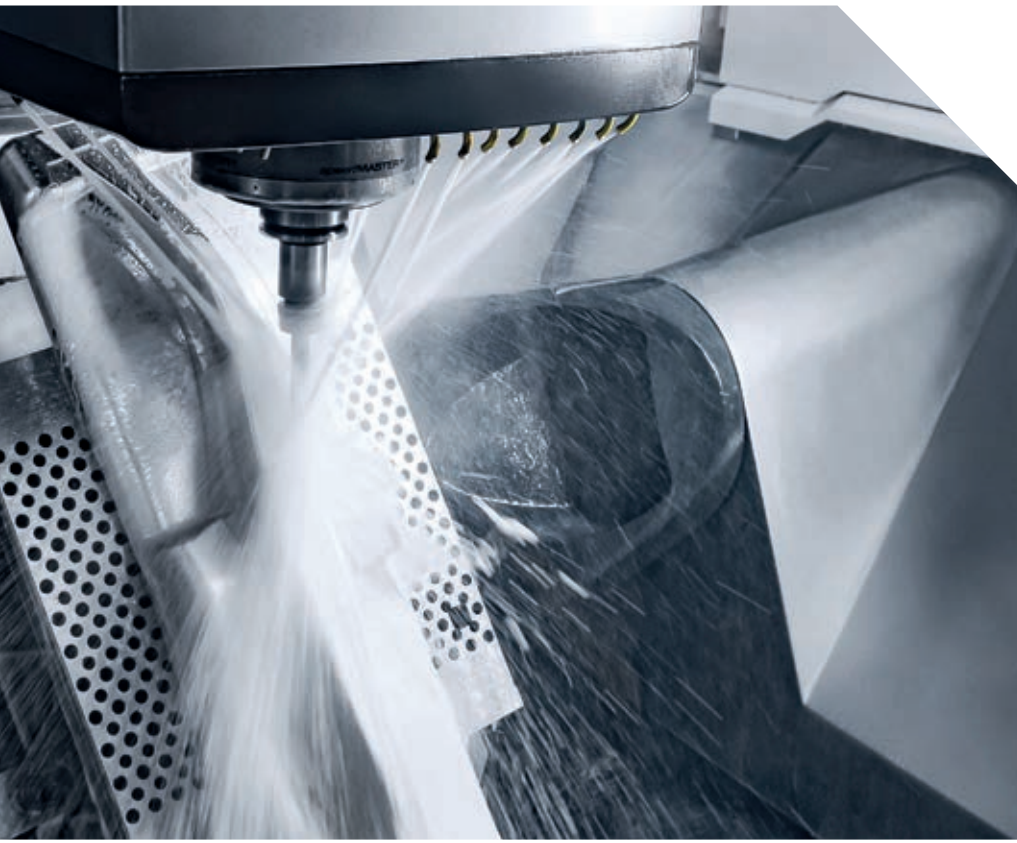
The recent equipment acquisitions have definitely raised the technology bar at Weber. According to DMG MORI's Piccione, the machine builder's integrated "technology cycles" make it possible, for example, to automatically "self-inspect" and tune kinematic accuracy using a simple test routine. In-process tool measurement and breakage monitoring, machine overload protection, and vibration control improve the end result of any machining process while safeguarding valuable assets. Also, the DMU 340 P's HSK 100 spindle is Weber's first foray into HSK tooling. Based on the results so far, it won't be their last.



"It's not uncommon to be stuck with a shopful of CAT 50 holders like we are," Hale says. "When you have 20 machines and 50 toolholders for each one, changing to a different standard is a tough financial decision to make. But we finally made the leap to HSK and that's where we'll stay from here on. Tool life is better, part accuracy and surface finish are better, everything just runs true."

24/7 manufacturing on the DMC 85 monoBLOCK

There's also the palletisation to consider. The DMC 85 monoBLOCK with its three-pallet system has only been on the floor for four months, with the second machine due to arrive this autumn. Together, the two machines promise to substantially increase throughput.



1. Sophisticated 5-axis machining on the DMC 85 monoBLOCK 2. With its three-pallet system, the DMC 85 monoBLOCK allows up to 20 hours of unattended operation
3. The DMU 340 P machines large workpieces to an accuracy of ± 0.05 mm

“Because our cycle times are fairly long, we were already getting 10 to 20 hours of unattended operation weekly per machine, but with the DMU 85 monoBLOCK we can look forward to running around the clock, including weekends,” says Edwards.

“Overall, we’re pleased with our decision. The folks at DMG MORI have been great to work with and the DMU 340 P especially has allowed us to reduce set-up times and further improve part quality. The end result is that we can turn jobs around 30 to 70 per cent faster, freeing the machine for additional work and helping us to grow our business.”

«

WEBER FACTS

- + International Engineer-to-order tool shop located in Midland, Ontario
- + Founded in 1962
- + Tooling for automotive interiors and exteriors, aerospace structures, and domestic products such as sinks and bathtubs
- + 230 employees in its 12,500 sq m (135,000 sq. ft.) facility.



Weber Manufacturing Technologies Inc.
16566 Highway 12, P.O. Box 399
Midland, Ontario, Canada L4R 4L1
www.webermfg.ca



The DMC 85 monoBLOCK allows day-and-night manufacturing.



Chris Edwards
President
Business Manager – Nickel Vapor Coated Graphite (NVCG)

5-AXIS MILLING

TECHNOLOGY LEADER FOR
MORE THAN 35 YEARS



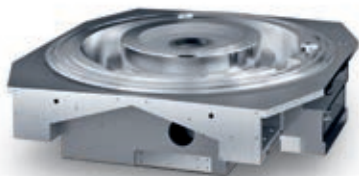
TOOL & MOULD MAKING

Radiator grille
Material: Carbon steel
finished on DMU 210 P
Component size:
1,570 × 950 × 578 mm



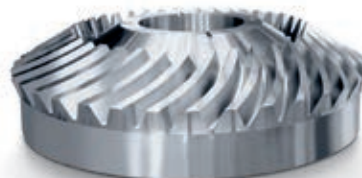
AEROSPACE

Gearbox housings for turbines
Material: Aluminium
holes better than H5
Positional tolerances:
12 – 15 µm



MECHANICAL ENGINEERING

Table support
Material: Cast iron
High-precision finishing
and 5-sided milling
Shape and positional tolerances:
in the region of 10 µm



GEARBOX MANUFACTURE

Spiral bevel gear
Material: Case-hardened steel
Complete machining with turning,
drilling, gear cutting Gear quality DIN < 5

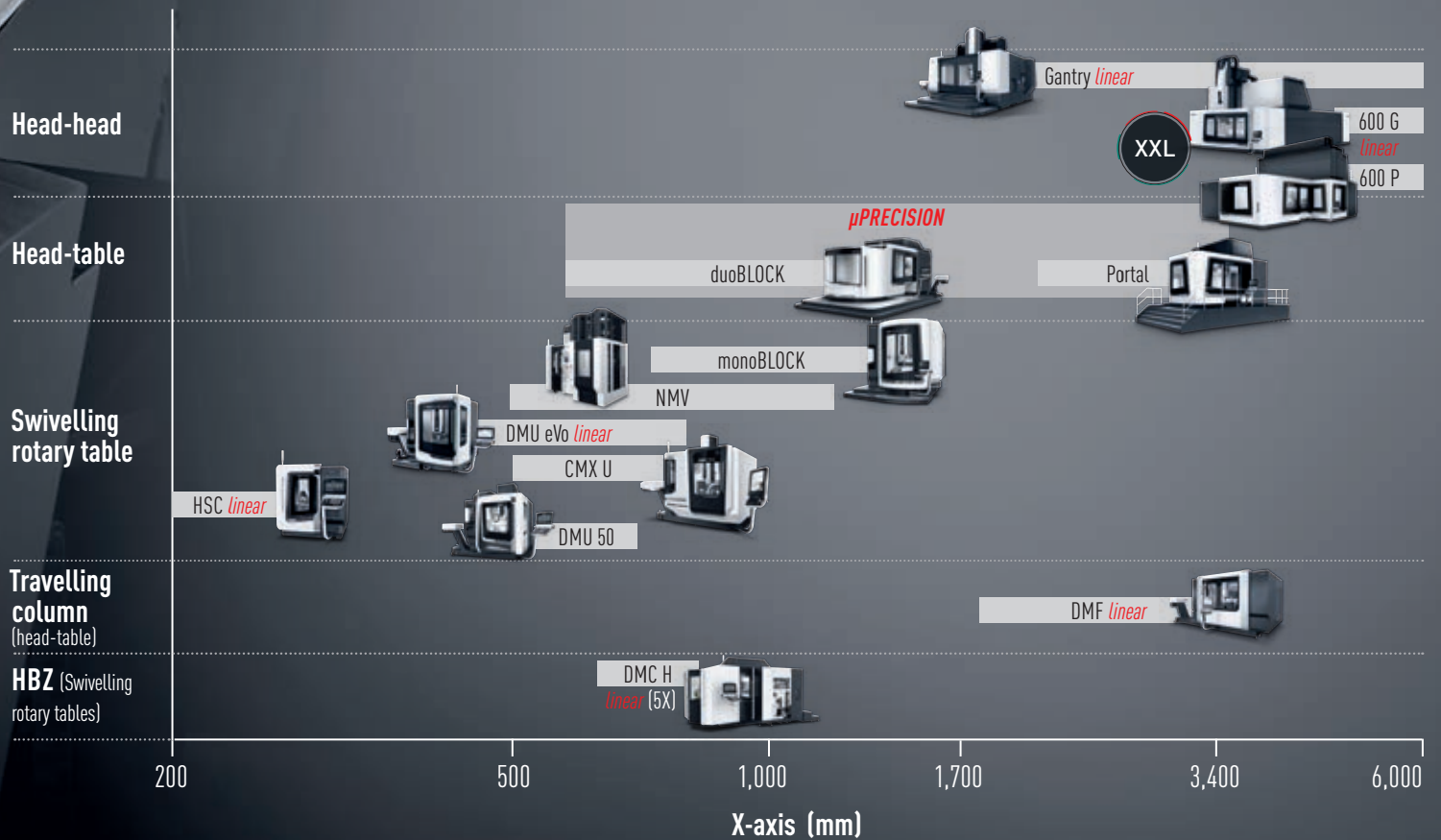


Up to 80% higher volumetric accuracy; thanks to 500 hours of manual scraping on the guideways and support surfaces.

THE RIGHT 5-AXIS SOLUTION FOR EVERY WORKPIECE

- + **5-axis solutions:** Swivelling rotary tables, rotating milling heads as A or B-axis and exchangeable milling heads
- + **Travels up to 6,000 mm** and up to **120 t max. workpiece weight**
- + **MASTER spindles** up to 30,000 rpm or 1,800 Nm incl. 36-month warranty with unlimited hours
- + **Excellent long-term accuracy** thanks to linear drives with up to 2g acceleration
- + **Maximum precision**, thanks to MAGNESCALE linear axis scales
- + **State-of-the-art 3D control technology:**
CELOS with SIEMENS, CELOS with HEIDENHAIN and CELOS with MAPPS

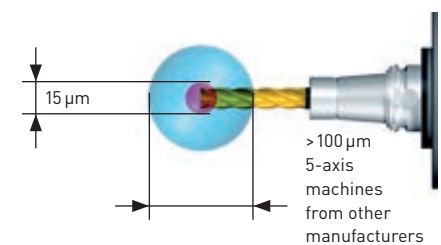
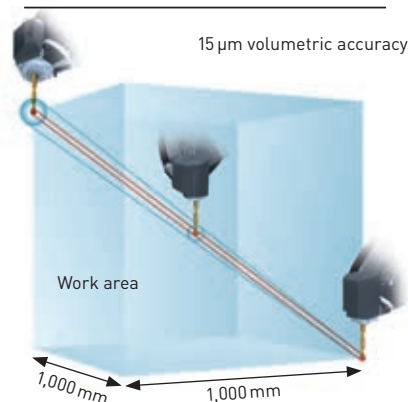
DMG MORI 5-AXIS PORTFOLIO



μPRECISION

- + **500 hours' scraping** on the guideways
- + **80 % higher volumetric accuracy** down to <math><15 \mu\text{m}</math>
- + **Positioning accuracy** of down to $3 \mu\text{m}$
- + **Individual optimisation** at the user's premises
- + **Available for the duoBLOCK and gantry range** (210/270/340)

3-TIMES HIGHER ACCURACY



At least 3-times higher accuracy over the whole machining volume.

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 the 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 22nd – 26th JANUARY

EVENT HIGHLIGHTS

- + Automation
- + Integrated Digitization
- + Additive Manufacturing
- + Technology Excellence



DMG MORI
live experience
events.dmgmori.com