

TECHNOLOGY EXCELLENCE

NEW
monoBLOCK
EXCELLENCE
FACTORY

DMG MORI

CO₂ neutral

FROM 2021:
CLIMATE-NEUTRAL
MANUFACTURING
OF OUR MACHINES

06



12



23



Page 06 // 100% climate neutral – now
Page 12 // monoBLOCK Excellence Factory:
Digital & automated

Page 23 // ALX series:
New automation solutions



06 SUSTAINABILITY

100% climate neutral – now

08 DIGITIZATION

myDMG MORI // NETservice //
Ebel Werkzeugbau GmbH

12 monoBLOCK – Excellence Factory

20 AUTOMATION

Automation portfolio from a single source //
New automation solutions for the NTX and ALX //
JR Machine // SQ Products AG // DMG MORI Davis //
Attabotics // PH 150 pallet handling system //
MAPAL Kompetenzzentrum Spanntechnik //
Top Grade Molds Ltd.

44 ENGINEERING & TECHNOLOGY

Interview Mr. Thönes & Mr. Geißler // CNC-Technik Heil GmbH //
Havlat Präzisionstechnik GmbH // Riemann GmbH //

62 SEMICONDUCTOR INDUSTRY

KT Tech Co., Ltd.

64 ADDITIVE MANUFACTURING

ULTRASONIC | LASERTEC // additive manufacturing //
LABVISION // Sulzer Management Ltd.

18 WORLD PREMIERE

DMF 200|8 –
The new traveling column series





MOVING FORWARD TOGETHER TO STAY AHEAD

The future of mechanical engineering can only be shaped collaboratively, courageously and by meeting challenges head-on. DMG MORI follows this principle and has taken responsibility for ensuring it is a reliable partner for customers by making its production environment future-proof. Hence, DMG MORI focuses on modular offers with innovative products and services for the customer's entire value chain – real and digital!

Dr. Mori, we are currently experiencing a very challenging period in mechanical engineering. What is important at the moment?

Dr. Mori: At the moment, our focus is on the future of automation and digitization as well

as close partnerships with our customers. These three pillars form the framework within which we continuously innovate our product and service portfolio – to ensure our customers are always up to date and that we are always able to improve, in close cooperation. Only when our customers are successful are we able to stay successful, too.

What is the role of automation?

Dr. Mori: During periods of upswing, the main focus is on building capacity as quickly as possible. Conversely, downturns provide time to critically examine internal processes in order to identify weaknesses and increase productivity and efficiency with targeted activities within the existing portfolio. And

there is no better “tool” than that of automation, which allows sustainable and measurable success to be achieved more quickly and economically!

What does DMG MORI offer its customers in this respect?

Thönes: We believe that almost all of our machine tools will be automated in the future. This trend has once again picked up pace. We are perfectly equipped for this with our modular portfolio of 52 automation solutions for workpiece or pallet handling. This means a diverse range of 154 machine models from DMG MORI can be equipped or upgraded.

»



Investments in innovations are the only way out of the crisis. This is why automation and digitization are given top priority at DMG MORI.

Christian Thönes
Chairman of the Executive Board
DMG MORI AKTIENGESELLSCHAFT

We differentiate between on the one hand machine-specific solutions with integrated robots or gantry loaders, such as the Robo2Go or the PH Cell pallet handling system with its universal applications, and on the other hand highly scalable solutions with linear pallet systems or freely configurable automation modules from our WH Flex and Matris modular building blocks – always paired with our own computer technology and new central tool management.

Dr. Mori: No other supplier offers a comparable machine portfolio with such a comprehensive automation program. The diversity and wide range of services is important to be able to tailor each and every automation project individually to the actual application.

It is equally important to our customers that all our automation solutions come directly from DMG MORI and are thus supplied from a single source, from brainstorming and project development through setup and commissioning to service and availability of spare parts.

Digitization is the second field of the future that every production company has to grapple with. This trend has also accelerated in recent months, hasn't it?

Thönes: That's very true. Investments in innovations are the only way out of the crisis. That's why automation and digitization are given top priority at DMG MORI. Above all, we see it as our duty to ensure our customers can make a systematic transition into the age of digitization; one that does not place too much burden on the company but nevertheless moves every company a decisive step forward. We have achieved exactly that with our Digital Manufacturing Package.

What does that mean?

Thönes: Imagine that you desperately want to attend an event but you are not allowed to enter or you no longer have a ticket. Do you know that feeling?

At DMG MORI we make sure that every door is open to customers when they begin their entry into digitization. To this end, the Digital Manufacturing Package offers all the essential features that a user requires for successful entry into the digital future.

1. Highly secure connectivity using the *IoTconnector* for open interaction within the company's own network and with decentralized production networks.
2. Maximum transparency regarding the status of the machines on the shop floor with our Messenger.
3. A direct line to the DMG MORI service department to optimize your service processes – with our *NETservice* and free access from machines to our customer portal *myDMG MORI*.
4. We offer the CELOS update for more than 20,000 installed CELOS machines – and thus access to our numerous further developed APPs, as well as to external software systems with the Application Connector.

But you do provide more than this entry-level offering?

Thönes: That's right, our digitization offer covers the entire shop floor – something that could be thought of as our customer's living room. One example is the new cloud-based PLANNING BOARD, which allows planning processes to be optimized directly from the shop floor, finally making Excel redundant. One other example is the TULIP system for optimizing process flows in the workshop and assembly.

As I understand it, the system is already being used in-house?

Thönes: What's more important is that more than 100 customers use the system successfully for process documentation, quality data acquisition, process data analysis, assembly instructions, staff training or machine monitoring.

What I personally find the most fascinating is the simplicity of the TULIP platform. Apps can be programmed on the shop floor for the shop floor without any IT skills – "Build your own APP" by people for people.

Of course, that's the reason why DMG MORI already uses TULIP at over 300 machining and assembly stations; for example in spindle assembly in Pfronten or now also in our new 4,000 m² monoBLOCK Excellence Factory!

What is special about the monoBLOCK Excellence Factory?

Dr. Mori: The core of the highly modern flowline assembly is an automated guided vehicle (AGV) transport system. These AGVs move the machines autonomously through the assembly process at a continuous

speed of 45mm/min. It takes 34 cycles to create any model in the complete range of monoBLOCK 5-axis machining centers from DMG MORI. Employees are supported at each assembly step by information, pictures and videos via a TULIP app, developed especially for this purpose.

Overall, the innovative concept boosts production capacity by 30 %, which means that 1,000 customer-specific solutions from the monoBLOCK series can be manufactured at Pfronten per year. The new Excellence Factory thus provides us and our customers with so many advantages that we plan to transfer this concept to other factories.

***Moving from the factory to the machine.
What sort of innovations are taking place
in traditional products?***

Dr. Mori: Of course, special mention should be made of the world premiere of the DMF 200|8 traveling column machining center, with which we are continuing a success story of over 3,000 machines that have been installed for 5-axis machining of long workpieces.

At the same time, we are also vigorously investing in the optimization of our product range. For example, the Precision Package is now standard on all monoBLOCK machines.

***That doesn't really feel like we're
in a crisis, does it?***

Thönes: Once again: Innovations are the only way out of the crisis. That's the reason we maintain all development budgets at the same level – in spite of the challenging conditions. We're also working on resilience and rightsizing instead of downsizing – which means there won't be any mass redundancies at DMG MORI. Moreover, we are aggressively investing in the quality of our range of services including unique full-service contracts and innovative financing options.

***DMG MORI recently announced
a climate-neutral – CO₂-neutral –
company carbon footprint ...***

Dr. Mori: ... of which we are very proud. But that's only the beginning for us. From January 2021, the entire value chain of our **GREENMACHINES** will be CO₂-neutral – from the raw materials to delivery to our customers. In addition, our DMG MORI machines today already work in **GREENMODE** with the highest efficiency and up to 30 % lower energy consumption. Our technologists will be working on new components for wind power, electromobility and fuel cells in the **GREENTECH** Excellence Centers in the future.

DMG MORI assumes responsibility!

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*Only when our customers
are successful are we able
to stay successful, too.*

Dr. Eng. Masahiko Mori
President and CEO
DMG MORI COMPANY LIMITED

100% CLIMATE NEUTRAL – NOW

DMG MORI ASSUMES HOLISTIC RESPONSIBILITY

FROM 2021:
MANUFACTURING
OF OUR MACHINES
WITHOUT
EMISSIONS

DMG MORI

CO₂ neutral

DMG MORI
CO₂ neutral

CTX beta 800 TC

100% CLIMATE NEUTRAL MACHINE MANUFACTURING

SUPPLIERS + **DMG MORI**



**NEUTRAL CO₂ FOOTPRINT OF ALL DMG MORI MACHINES –
FROM THE RAW MATERIALS TO DELIVERY**

1. NEUTRAL PRODUCT CARBON FOOTPRINT



All machines delivered
from January 2021 will be manufactured
in a climate-neutral way.

2. NEUTRAL COMPANY CARBON FOOTPRINT



DMG MORI has been climate neutral in its
own value creation since May 2020.

UP TO 30 % ENERGY SAVINGS*



1. CELOS APPS FOR TRANSPARENCY AND OPTIMIZATION OF ENERGY CONSUMPTION
2. INTELLIGENT, DEMAND-ORIENTED CONTROL
 - + Frequency controlled hydraulic unit
 - + Demand-based air purge
 - + Cooling unit with added water
3. CONSUMPTION-OPTIMIZED COMPONENTS
 - + Clamping cylinder oil leak alarm
 - + LED work area light
 - + Energy-efficient control cabinet cooling
4. ENERGY RECOVERY DURING BRAKING

*Compared to previous machine models

FOLLOW OUR PATH TO CLIMATE NEUTRALITY

All-round sustainability to protect the environment. Our **company carbon footprint** – i.e. DMG MORI value creation – is already climate natural. We are now taking a further step: As one of the first industrial companies to do so, from 2021 we will be manufacturing all machines with a 100 % climate-neutral **product carbon footprint** – from the raw materials to delivery! Follow our example of the **GREENMACHINE**: Together with our partner "Fokus Zukunft GmbH" we would be pleased to show you our path to climate neutrality!

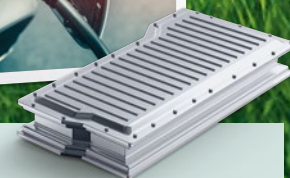
We think in terms of all-round climate protection and also focus on green machine usage. The efficient operation of our machines with up to 30 % energy savings (**GREENMODE**) reduces costs and enables access to attractive subsidies. We would be happy to help you! Moreover, the solutions from DMG MORI play a key role in the production of green technologies such as wind and water power and new drives (**GREENTECH**). To this end, our Excellence Centers have been building up specialized expertise in this area for many years. We would like to be an innovative partner for our customers in this field of the future.

Peter Frieß
Managing Director,
Fokus Zukunft GmbH
peter.friess@fokus-zukunft.com



MACHINE UTILIZATION

CUSTOMER



DMG MORI



MORE EFFICIENT ENERGY AND EMISSIONS MACHINE OPERATION

1. Up to 30 % energy savings compared to previous machine models
2. Opens up access to many state subsidy programs – get in touch with us!

DMG MORI



TECHNOLOGY EXCELLENCE FOR GREEN TECHNOLOGIES

1. Green technologies like wind power and electromobility are the most important leverage against climate change
2. DMG MORI is the innovation driver for the production of green technologies

FASTER SERVICE,
NO QUEUES,
AN OVERVIEW OF
EVERYTHING.

Availability, fast support and transparency are the foundation for excellent service. You will have all this under control with myDMG MORI – and at no extra charge.

Dr. Thomas Froitzheim
Managing Director
DMG MORI Global Service GmbH

YOUR HISTORY

YOUR MACHINES

myDMG MORI
CUSTOMER PORTAL

YOUR DOCUMENTS

REGISTRATION
IN < 3 MIN.

YOUR SERVICE REQUESTS

A NEW SERVICE CONCEPT!

A CUSTOMER PORTAL USED BY OVER 20,000 CUSTOMERS
IS NOW LAUNCHED IN THE USA

myDMG MORI was first implemented in the European countries and will soon be celebrating its first birthday! Looking back, how do you think the customer portal has performed up to now?

Very positively. After just one year, our customer portal myDMG MORI has become indispensable to our customers. You can

experience the added benefits right from the first time you use it. The online service enquiry eliminates queues, searching for the machine number and also any misunderstandings when making a request. Thanks to the intuitive operation and the direct routing to the right service experts, myDMG MORI has proven itself as not only more convenient but also capable of finding a solution faster

compared with reaching for the telephone. The myDMG MORI app makes it possible to track the process status at any time – live and from any location. And our customers really appreciate the availability of all documents.

So the start has been extremely successful.

What are the next steps?

Well, we certainly won't be resting on our laurels! A further milestone will be direct communication with the service expert responsible for the case throughout the entire period. Moreover, suitable solutions will also be provided based on the inquiry under the keyword "self-service". What's important is that myDMG MORI is and will remain free of charge.

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- + **30 % time-savings** and maximum transparency compared to service hotlines
- + **myDMG MORI has the right of way** – the highest priority in processing
- + **Track & trace** – live and up-to-date processing status at all times
- + **Free of charge** – myDMG MORI is and will remain free of charge

DMG MORI'S SOLUTIONS TO REMOTE SERVICE

ENHANCED SUPPORT WITH NETservice



NETservice takes our customer experience to the next level. Customers save time explaining the issue or waiting on an arrival of service experts since the DMG MORI team can directly see what is happening on the machines. It definitely speeds up our service process.

Amane Sudo
Chief Operating Officer
DMG MORI Software Technology Solutions USA, Inc.

SERVICEcamera

- + **Optional camera** developed by DMG MORI
- + **Plug-and-Play** livestream connection for NETservice
- + **Fast and secure** WiFi transmission
- + **Splash-proof** housing

In addition to myDMG MORI, we are pleased to introduce NETservice as another highlight of our Digital Service solutions.

When in-person visits are not possible—for example, due to a pandemic lockdown, remote assistance is key to ensure our customers can still receive excellent support. NETservice allows DMG MORI Service to assist and diagnose customer's difficulties by a secure remote connection to their machine. Together with DMG MORI 24/7 hotline, customers can expect a quicker diagnosis and recovery.

Improved communication during phone support

As manufacturers look to increase their production while staying on schedule with deadlines, unexpected downtime can be costly. We are determined to have our customers back up and running as soon as possible. However, traditional phone support lacks the capability to fully capture the customer's downtime

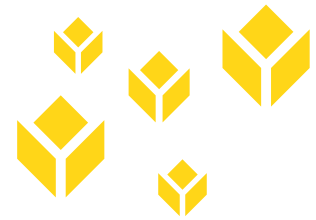
issues. Getting customer communications right is critical and with we can do so. Our DMG MORI hotline can see exactly what the customers see on their control panel through a secure remote access for a deeper investigation.

Optional livestreaming camera

Now what if customers want to show physical objects such as parts or a spindle inside of the machine? With SERVICEcamera, an optional handheld camera integrated with NETservice, customers can livestream video of any issues and will be reflected on the DMG MORI side.

«

DIGITAL PROCESS SUPPORT POWERED BY TULIP



1

2



1. TULIP provides EBEL with the possibility of building individual apps by drag & drop that support all processes of an order digitally. 2. The latest models on the EBEL shop floor are equipped with the CELOS control and operating system, from which it will be possible to call up TULIP apps directly in future.

With TULIP we can now support our processes integrally and measurably.

Frank Ebel (on the right)
Managing Director of Ebel Werkzeugbau
Alex Huhn, responsible for design

Since 2001 Ebel Werkzeugbau GmbH from Arnsberg has specialized in the design and production of progression and punching tools, mainly for the automotive sector. The 30-strong team in production use ten machine tools from DMG MORI, including 3-axis DMC V vertical machining centers in various sizes plus a 5-axis DMU 50 3rd Generation with PH 150 pallet storage system. Recently EBEL has enhanced its modern production – the DMG MORI models are five years old at most – with TULIP apps that can be adapted individually to all operations and that enable digital process support.

“Our work begins with customer consultation”, is how Frank Ebel describes the approach of the company. The company from Arnsberg built and delivered 56 tools in 2019 alone. EBEL’s strength lies in the small size of the company, says the managing director: “Our flat management structure means we can respond flexibly and meet the high

expectations of our customers.” The expertise in design and production is incorporated into new projects very early on. “Wherever necessary our developers can support customers with regard to feasibility and can optimize production processes.” Progression tools up to three meters in length and weighing up to six tons, which EBEL inspects completely, are created in this way.

Uniform control for all machines

The reason EBEL has worked with machine tools from DMG MORI from the very beginning, claims Frank Ebel, is the wide diversity of models and the option of using controls from HEIDENHAIN. “This means we can deploy personnel flexibly.” Frank Ebel has the goal of designing processes in the company sustainably in parallel with the consistent modernization of the shop floor – the latest models are equipped with the CELOS control and operating system. This is where TULIP from DMG MORI comes into play.

TULIP now means that we are no longer dependent on external IT service providers but instead can digitize our own processes step by step.



Amane Sudo
Chief Operating Officer
DMG MORI Software
Technology Solutions USA, Inc.

TULIP for digital process support

While DMG MORI's core business is to design and install complete manufacturing solutions, the machine tool manufacturer pursues a different philosophy with TULIP. Alex Huhn, responsible for design at EBEL explains: "We discussed what we require from digital process support from DMG MORI and then received the basic framework of a TULIP app." Important here is the agile evolution of the app – without any knowledge of programming. Like a training kit, every stage of a process can be described and visualized on the TULIP platform, using either existing templates or self-built apps. "The software enables us to build individual apps using drag & drop, which support all processes of an order digitally."

Thanks to the flexible approach in line with the motto

"Build your own APP", a large number of digital APPs can be created for:

1. Digital process documentation and tracking
2. Digital defect and quality data recording
3. Digital process evaluation and analysis
4. Interactive assembly and operator guidance
5. Digital staff training
6. Machine and shop floor monitoring

End-to-end and paperless process documentation

The use of TULIP starts with the design. "We give each drawing a barcode, which we scan. This allows the first capture of the component by the TULIP app", says Alex Huhn. From that point onwards every further step is documented in the app. "We have already installed three stations on which we use the TULIP

EBEL uses TULIP at three stations in the design, machining and assembly departments.

app: in the design, machining and assembly departments." Staff start each process step, milling for example, in the app and end it there on completion and release the component for processing at the next station. "The app can also be installed directly on the machine – on CELOS", adds Alex Huhn. The goal is to accompany all existing analog activities step-by-step with the aid of the app. "This extends from the documentation through to detailed activity descriptions for assembly processes – and all without any unnecessary paperwork."

Transparent processes at the touch of a button instead of cumbersome Excel spreadsheets

Frank Ebel sees the added value of TULIP in the permanent traceability of the production status of a machine tool. "As far as project times of several weeks are concerned, it is good to know where our orders stand at all times." Thanks to TULIP, this happens in real-time at the touch of a button. "Previously, we had to manage Excel lists at the same time to maintain an overview." Decisions were often based on gut feeling. "With TULIP we can now support our processes integrally and measurably and make decisions based on objective data."



BUILD YOUR OWN APP!

THE EASIEST WAY TO DIGITIZATION OF YOUR SHOP FLOOR PROCESSES

HIGHLIGHTS

- + **No Code:** Create your own APPs without programming knowledge
- + **APP templates:** Faster innovation with customizable APP templates
- + **Open interfaces:** Easy connection of existing IT systems (ERP, MES, CAQ) as well as digital sensors and machines

APPLICATION AREAS

- + Process documentation
- + Quality data acquisition
- + Process data analysis
- + Assembly instructions
- + Digital operator training
- + Machine monitoring
- + and much more.

EBEL WERKZEUGBAU GMBH FACTS

- + Founded in Arnsberg in 2001
- + 30-strong team
- + Design and production of progression and punching tools for the automotive sector



WERKZEUGBAU

Ebel Werkzeugbau GmbH
Zum Möhnewehr 5
59755 Arnsberg, Germany
www.ebel-wzb.de



The software enables us to create individual APPs using drag & drop that digitally accompany our processes relating to an order.

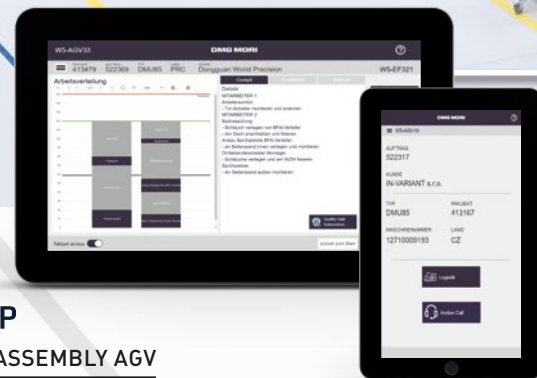
Alex Huhn

Responsible for the TULIP project at Ebel Werkzeugbau

PRODUCTION
START
SEPTEMBER 1ST
2020

monoBLOCK EXCELLENCE FACTORY

DIGITAL & AUTOMATED



TULIP ON EVERY ASSEMBLY AGV

- + Fully digitized value-creation chain
incl. all assembly and test processes
- + 1x tablet for customer-specific drawing information,
documentation for quality gates, images + videos
with assembly instructions
- + 1x interactive status monitor directly on every AGV
for production progress and logistics orders

The continuously flowing assembly line in the new monoBLOCK Excellence Factory at the DMG MORI Pfronten site has revolutionized manufacturing of the successful monoBLOCK machining centers and enabled a 30 % increase in productivity.

HIGHLIGHTS

- + Excellence Factory covering 4,000 m²
- + AGV – automated guided vehicle system
 - continuous assembly flow 45 mm/min
- + Full model mix: DMU/DMC incl. FD
 - max. up to 1,000 machines per year
 - 34 work cycles every 2.5 hours
 - 7-day throughput time per machine
- + 30 % reduction in throughput time
- + Fully digitized –
 - All assembly and test processes





The new monoBLOCK Excellence Factory has revolutionized manufacturing of the successful monoBLOCK series and enabled a 30 % increase in productivity.

Mr. Horn, Mr. Musch, the Excellence Factory is considered to be the most modern assembly line for machine tools. What are the most important advantages compared to previous monoBLOCK production?

Michael Horn: Our team has designed a flow assembly line based on a driverless AGV (automated guided vehicle) transport system, which is perfectly integrated into the digital value chain of our production site. Compared to rail systems, AGVs are a much more flexible solution, which enables the optimization of the manufacturing infrastructure.

Reinhard Musch: Our goal was to increase the efficiency of the space and enable the complete model mix of the monoBLOCK series to be manufactured in a highly flexible and even more productive way. The result is that we have been able to reduce throughput times of the machines by 30 percent, irrespective of the model.

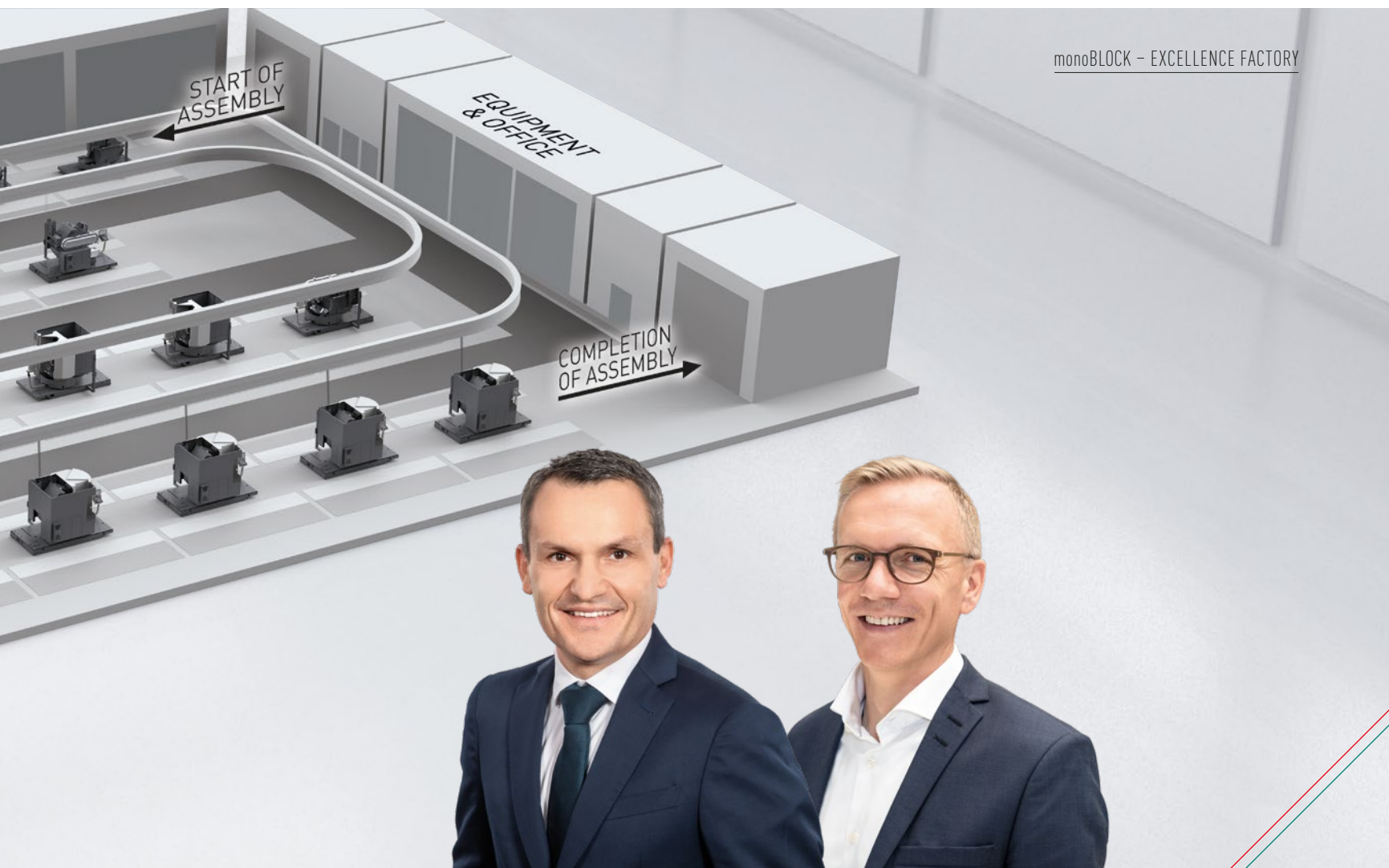
How has working with the monoBLOCK changed manufacturing?

Reinhard Musch: Because we got our specialists involved in the design of the Excellence Factory right from the start, we



have been able to improve all the processes in terms of ergonomics and create an optimal working environment. The low height of the AGV at 400 mm and corresponding platforms, tools and aids enable easy access and assembly.

Michael Horn: A custom-developed TULIP APP supports each assembly step. The APP was developed together with our team, meaning that all employees can benefit from this expertise. It is made possible by machine-specific work plans for each cycle and the required material.



The new monoBLOCK Excellence Factory provides us and our customers with so many advantages that we plan to transfer this concept to other factories.

Michael Horn
Member of the Executive Board of
DMG MORI AKTIENGESellschaft

We are passing on all of the benefits of over 30 % increased productivity and greater space utilisation to our customers. We are therefore decreasing the price of all DMU and DMC monoBLOCKs with immediate effect.

Reinhard Musch
Managing Director
DECKEL MAHO Pfronten GmbH

In the case of newly introduced equipment or special options, detailed drawings and video instructions provide support to employees in real time and it is completely paperless.

What added value does modernized manufacturing in the Excellence Factory have for customers?

Michael Horn: The enormous popularity of the monoBLOCK machines has led to high demand for the entire model mix. This is because monoBLOCK machining centers today feature a very comprehensive modular system that allows individual configurations

for every application. We have adapted our production methods to meet this demand. All configurations can be produced in the Excellence Factory even more flexibly and in a continuously flowing manufacturing process. Capacity can be scaled according to need and increased from 600 to over 1,000 customized monoBLOCK models per year.

Reinhard Musch: Customers also benefit from TULIP digitization. The entire assembly process is documented and quality gates are marked on the basis of interactive check lists and test plans. That offers us end-to-end

quality control along the entire assembly line. We can thus identify and remedy potential errors as early as possible. All these measures ensure more efficient processes and result in shorter and consistent delivery times across the entire product mix – and we are now passing on the increased productivity efficiency to our customers with a price reduction of 10,000 euros for every monoBLOCK machine.

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With the productivity bonus and the accuracy package as standard, we are passing on savings directly to our customers!

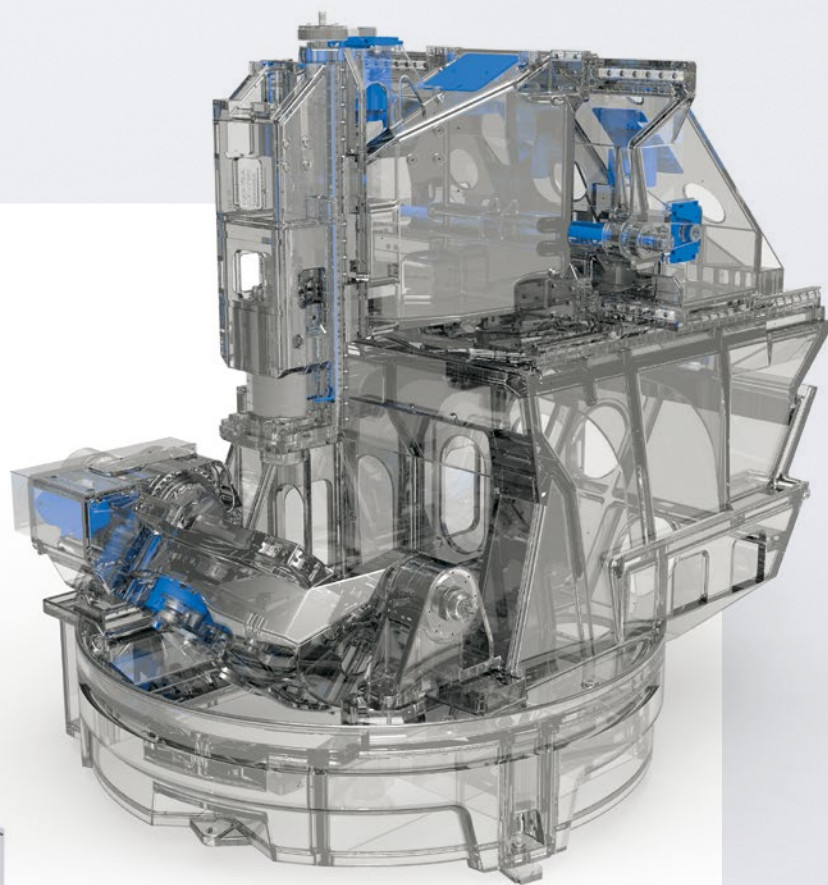
Cornelius Nöß
Managing Director
DECKEL MAHO Pfronten GmbH



ACCURACY PACKAGE NOW AVAILABLE AS STANDARD

25 % INCREASE IN PRECISION THANKS TO EXTENSIVE COOLING AS STANDARD

- + Applies to all DMU/DMC monoBLOCK sizes
- + Cooled motors in all axes (X/Y/Z/A/C)
- + Internally cooled ball screws in all axes (X/Y/Z)
- + Cooled motor plate in the X/Y/Z axes
- + Consistent temperature control in the machine thanks to Y-axis cover and air circulation fan



Travel paths	DMU 65	DMU 75	DMU 85	DMU 95	DMU 105	DMU 125	DMC 65	DMC 75	DMC 85	DMC 95
X (mm)	735	750	935	950	1,135	1,335	735	750	935	950
Y (mm)	650	650	850	850	1,050	1,250	650	650	850	850
Z (mm)	560	560	650	650	750	900	560	560	650	650

Flexible!

Unrestricted crane loading
from above

600 kg

Retrofittable!

Connection possible to existing machines that
already have an integrated automation interface
+ subsequent expansion with
a second rack module

Unique!

Direct loading from
the front possible

Compact!

Up to 40 pallets in a
footprint of 10.7 m²

PH CELL

MODULAR PALLET HANDLING FOR UP TO 40 PALLETS

AVAILABLE
FOR 18 TYPES
OF MACHINE

HIGHLIGHTS

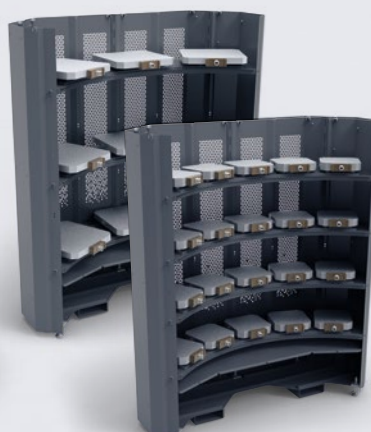
- + **Excellent ergonomics and accessibility** to the work area thanks to side loading
- + **Can be expanded** with a second rack module
- + **Can be retrofitted** with a prepared machine interface
- + **Short commissioning time** thanks to defined interface and modular system
- + **For 18 types of machine**
 - CMX 600/800/1100 V
 - DMC 650/850 V
 - DMU 65 H monoBLOCK
 - CMX 50/70 U
 - DMU 50 3rd Generation
 - DMU 65/75/85/95 monoBLOCK
 - DMU 40/60/80 eVo
 - DMF 200 | 8
 - DMU 80/90 P duoBLOCK

**PALLET CHANGER**

+ Up to 300 kg transfer weight
(workpiece incl. pallet)

**SEPARATE SET-UP STATION**

+ Ergonomic SET-UP
+ Rotatable option

**RACK MODULE**

+ Can be combined
for different pallet sizes

NUMBER OF PALLETS (2 × RACKS)

Pallets	Workpiece height	
	500 mm	300 mm
Size		
500 × 500 mm	# 9 (18)	# 12 (24)
400 × 400 mm	# 12 (24)	# 16 (32)
320 × 320 mm	# 15 (30)	# 20 (40)

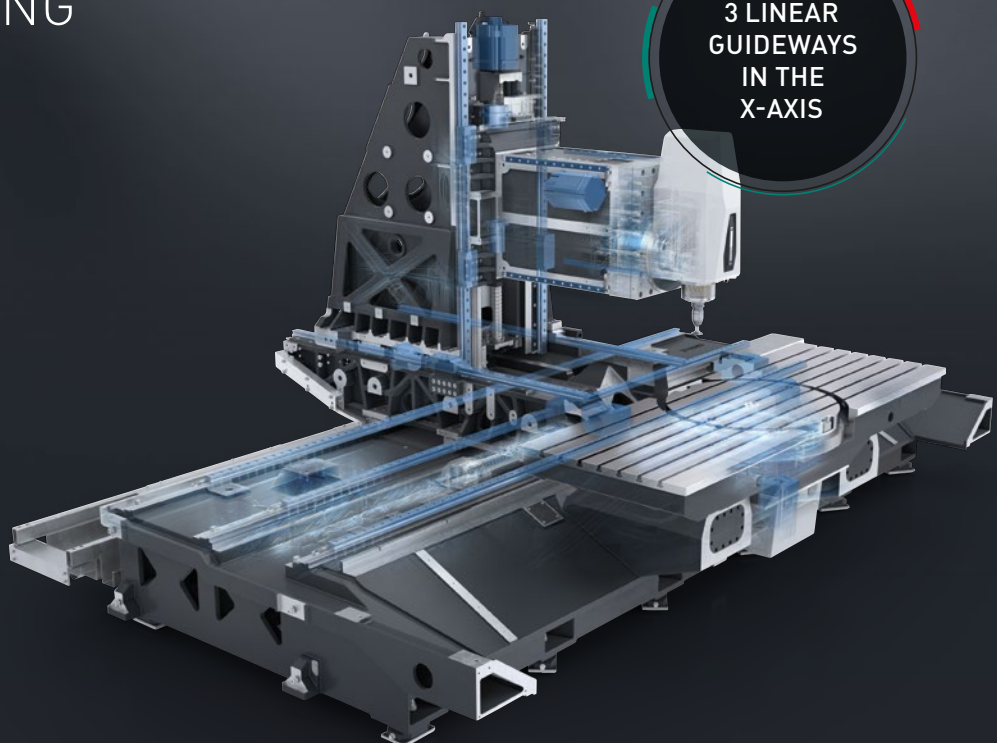
WORLD
PREMIERE
2020



DMF 200 | 8

THE NEW TRAVELING COLUMN SERIES

- + **Maximized rigidity** thanks to 3 linear guideways in the X-axis
- + **Reliable milling performance** thanks to consistent overhang
- + **Optimal surface finish and accuracy** thanks to direct drive in the Y-axis and Z-axis and integrated cooling
- + **Maximum flexibility** when machining thanks to the B-axis milling head with $\pm 120^\circ$ swivel range
- + **Large work area** with travels of X = 2,000 / Y = 800 / Z = 850 mm
- + **Unique and innovative tool change**, fast, collision free and with process reliability behind the work table



3 LINEAR
GUIDEWAYS
IN THE
X-AXIS



DMF 200 | 8 WITH PH CELL*

NEW SOLUTION FOR NEW POSSIBILITIES

- + Unparalleled increase in **productivity** thanks to maximum utilization of the DMF machine
- + **5-axis simultaneous** machining of components with a pallet size of up to 500×500 mm
- + **Simple integration** thanks to PH Cell modular automation system
- + Up to **40 pallet positions** possible

*available from Q2/2021

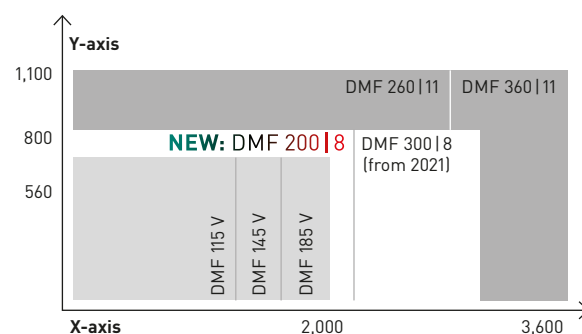
The 3 linear guideways in the X-axis, thermal stability through holistic cooling and direct drives enable optimal surface finish and accuracy.

Fabian Suckert
Member of the management
at DECKEL MAHO Seebach



PACKAGED EXPERTIZE IN TRAVELING COLUMNS

- + **Completion of the DMF series:**
Integration of DMC V machines with traveling column and 700 mm Y-axis
– Universal options and expansion stages, e.g. spindles and tables
- + **Pooling of expertise in traveling columns at DMG MORI in Seebach:**
An integrated concept based on a modular system
– DMF V: 3-axis vertical machining (X-axis: 1,150 to 1,850 mm)
– DMF: 5-axis simultaneous machining* (X-axis: 2,000 to 3,600 mm)

*5th axis optional

THE NEW DMF SERIES		
DMF V	DMF	
DMF 115 V X/Y/Z: 1,150/700/550 mm		
DMF 145 V X/Y/Z: 1,450/700/550 mm	DMF 200 8 X/Y/Z: 2,000/800/850 mm	DMF 260 11 X/Y/Z: 2,600/1,100/550 mm
DMF 185 V X/Y/Z: 1,850/700/550 mm	DMF 300 8 X/Y/Z: 3,000/800/850 mm	DMF 360 11 X/Y/Z: 3,600/1,100/550 mm
4-axis machining with B-axis head	5-axis simultaneous machining	
Y-axis travel: 700 mm → NEW: DMF V	Y-axis travel: from 800 mm to 1,100 mm → DMF	

AUTOMATION PORTFOLIO FROM A SINGLE SOURCE

52 PRODUCTS INCLUDING INTERFACE

MODIFICATION TIME



WORKPIECE HANDLING

PALLET HANDLING

TURNING



IMTR (NTX 1000)



SR (WASINO)

MILLING



WH Cell¹

3, 6, 8, 15
and 25 kg
max. workpiece
weight



3. Robo2Go



AWC (NMV / CMX V)



RPS²

PH Cell



PH 150

SPECIFIC TO THE MACHINE

UNIVERSAL

12

PRODUCT LINES

52

PRODUCTS



GX/GX T



MATRIX



WH FLEX



Technology expertise, machine and automation from a single source. Make your production future-proof with DMG MORI.

Marlow Knabach
Chief Technology Officer
National Engineering
DMG MORI USA, Inc.



LPP



CPP



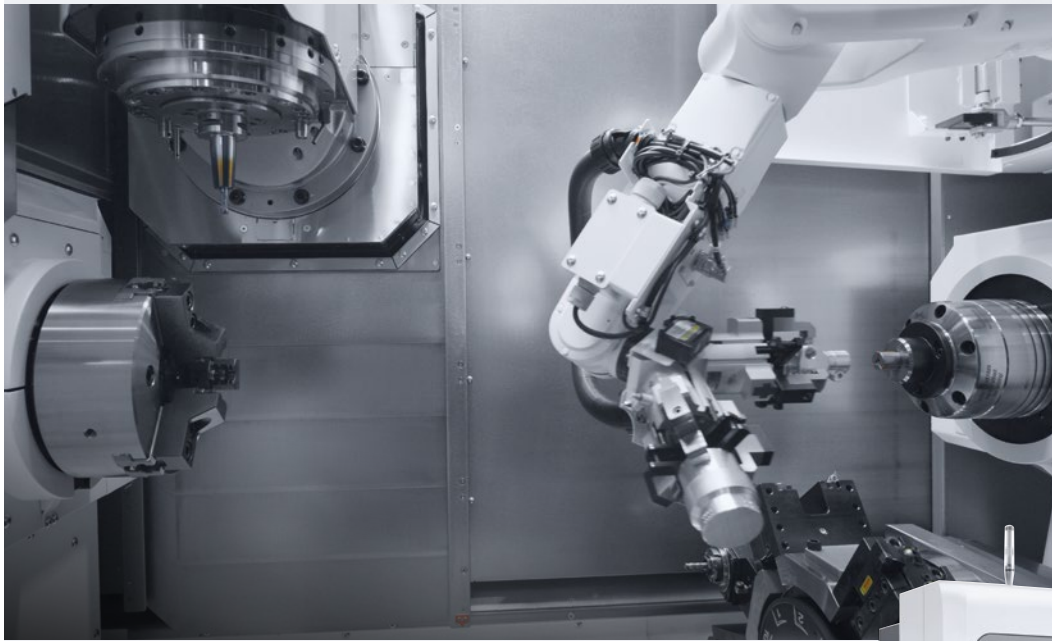
PH-AGV

SCALABLE (≥ 1 MACHINE)

→ COMPLEXITY

¹DMP, CMX V, CMX U, DMU 50, DMU monoBLOCK, DMU eVo, LASERTEC 50

²NHX, DMC H *linear*, monoBLOCK, duoBLOCK, Portal



NTX 1000 IMTR, PERFECT AUTOMATION

IMTR – In Machine Traveling Robot

- + Loading and unloading with robots
- + Automatic tool change at the lower turret by robots
- + Different types of storage, e. g. tray storage or workpiece storage incl. container change (option)



Transfer weight	Max. workpiece weight		Max. workpiece diameter*
	Single gripper	Double gripper	
10 kg	7.5 kg	2.25 kg	ø 100 mm
14 kg	11.5 kg	4.25 kg	ø 100 mm

*Workpiece length depends on the total weight

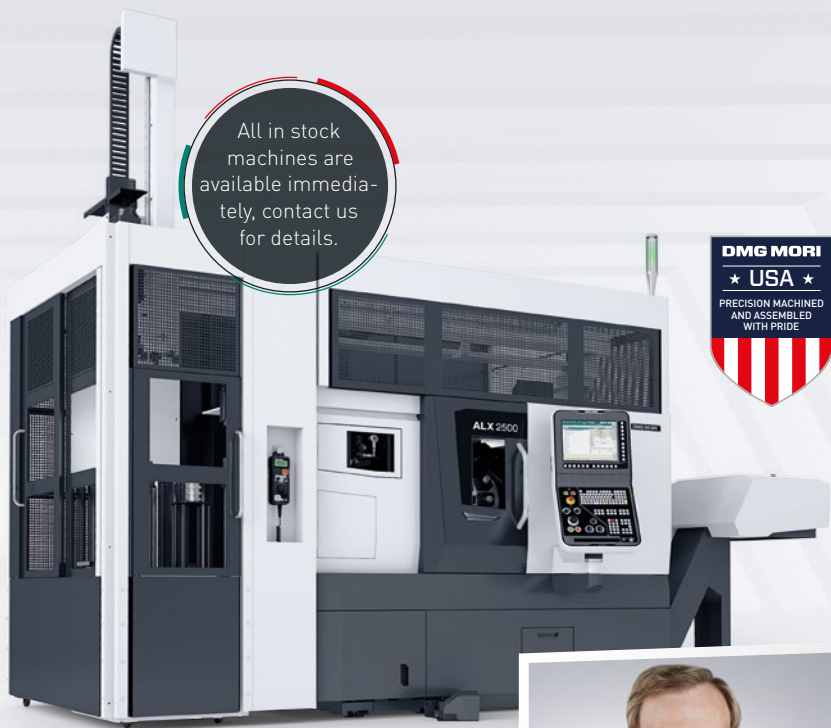


MAGAZINE FOR UP TO 246 TOOLS

- + Versions with 194 or 246 tool pockets
- + Can also be used with a bar loader
- + One-button operation
- + 2 tool chains for tool replenishment during production (chain A operating, chain B setting up)

Max. tool length	400 mm
Max. diameter (with occupied adjacent pockets)	70 mm
Max. diameter (with free adjacent pockets)	130 mm
Max. tool weight	8 kg

All in stock machines are available immediately, contact us for details.



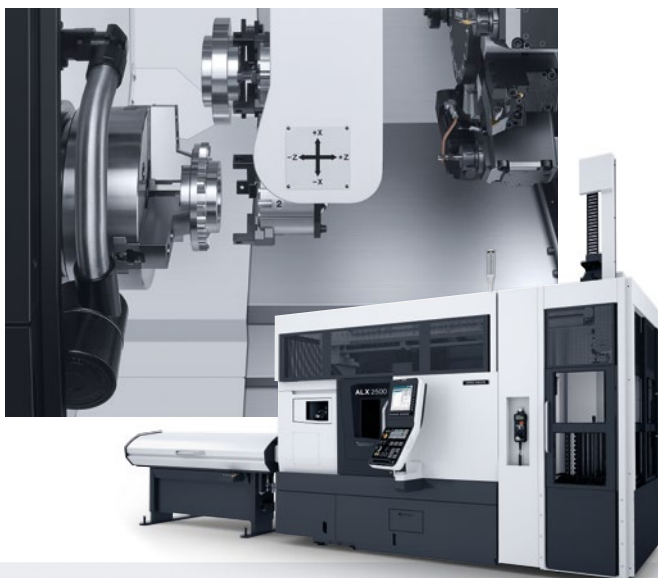
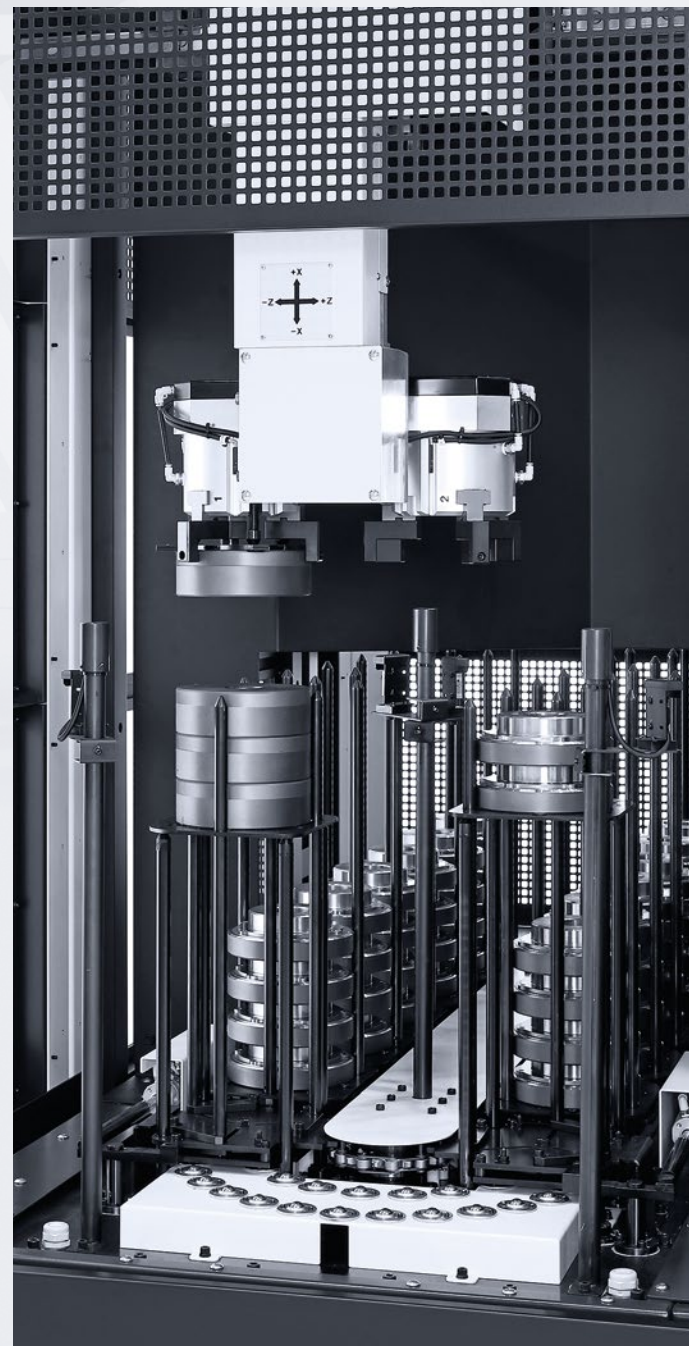
John McDonald
Executive Vice President
Davis Development & Product Department



ALX SERIES NEW AUTOMATION SOLUTIONS

GX – workpiece handling

- + Fastest part load/unload time with 180/200 m/min (X- / Z-axis) gantry rapid traverse
- + Introduce new parts quickly – gantry controlled through 2-additional machine axes
- + Handling of work
- + Pieces up to $\varnothing 200$ mm, length 150 mm, 15 kg
- + Rotary Stocker with 14 to 26 pallets



GX 7 GANTRY LOADER IN COMBINATION WITH BAR LOADER

- + Ideal solution for delicate high-value parts
- + Raw material feed via bar loader and workpiece removal via gantry loader
- + Various sizes of workpiece:
 - Only the machine: $\varnothing 366$ mm \times 500 mm*
 - Gantry loader: $\varnothing 150$ mm \times 120 mm, 7 kg*
 - Gantry loader + bar loader: $\varnothing 80$ mm \times 120 mm, 7 kg*

* ALX 2500 | 500 (milling specification)



Check the status of your shopfloor from any device with a browser and network connection: PC, tablet, smartphone, or in CELOS.



EXCELLENCE IN EFFICIENCY: JR MACHINE AND DMG MORI MESSENGER

Established in 1992, JR Machine in Shawano, WI is a ISO-certified leading contract manufacturer for OEM and Tier 1-2 manufacturers. They serve a variety of industries, from heavy machinery and equipment, to military and defense, hydraulics, fire suppression, medical technology, vehicle racing, and energy. JR specializes in complex precision-machined parts up to 10" in diameter and 28" long, as well as manufacturing services such as prototyping, engineering, CNC welding, and assembly.

Twenty-three DMG MORI machine tools are installed in total, with a majority based on the proven DMG MORI NLX 2500 platform. Most recently they expanded in automation – two multi-turret NZX 2000 Gantry machines were installed in the past year to drive higher production in a compact footprint.

JR's success can in part be attributed to their application of Lean Manufacturing principles. A key element of the improvement was the installation and application of DMG MORI Messenger.

Data-Driven Manufacturing

Five years ago JR began utilizing Messenger, DMG MORI's web-based monitoring software that provides live status, alerts, and data collection capabilities. One such capability is the ability to keep track of actual machining time – a data set that is nearly impossible to capture without software.

Based on this capability, JR created a simple metric in order to drive and track improvements. By comparing direct payroll hours to actual machining hours, they could see exactly how efficient the shop was running.

Initial results showed room for improvement. Only 0.57 to 0.88 machining hours were taking place for every hour of labor.

Doubled Operational Efficiency

Operational time such as workpiece transfers are often the largest contributor to loss of machining time. JR was able to reverse this by tracking these inefficiencies in Messenger and targeting them for improvement, driving the metric up to above 1.0. Nowadays the metric hovers between the 1.2-1.4 range. This means every operator is responsible for more than one machine on their shift.

President Tim Tumanic adds, "through our continuous improvement efforts – and DMG MORI Messenger is a part of that – we were able to drive our direct labor from 18% down to 11%"



DMG MORI Messenger is available by trial and purchase for DMG MORI and third-party machines. Limitations may apply. For more information please go to dmgmori.com/messengertrial or contact your Area Sales Manager.



Today the software is used for monthly metrics and live monitoring on a large display in the shop. "At the end of a month we pull together the direct labor hours and the machine hours and assign the productivity index. That's one of our key metrics on our monthly scorecard," says Mr. Tumanic.

MANUFACTURER OF THE YEAR

He adds that local support is also convenient, as DMG MORI maintains a US-based software team.

Continuous Improvement Culture

One hurdle of installing monitoring software can be operator reception. Some machinists may worry that software is installed for operator oversight. When asked about such a response, Mr. Tumanic says it is simply not the case.

"That was communicated to our employees when we put it in. Let's use this as a tool to get better – it isn't Big Brother looking over your shoulder. And because of the culture we've built, that's not even a consideration. Culture and open communication are the key – that drives the culture."

This culture has expanded the business by over 55% in recent years, and in 2019 they won the Wisconsin Manufacturing & Commerce "Manufacturer of the Year" among companies with less than 100 employees.

Smart Business

Tracking machine productivity has also empowered JR to make smart investment decisions. Each machine addition is proven by monitoring data. Messenger is used to identify equipment limitations and expand capacity.

When asked about the future of machining, Tim's message was clear: "We see more automation." JR Machine recently began utilizing bar feeding on their NLX machines, and their most recent NZX 2000 Gantry expansion uses three turrets and an integrated gantry system to achieve maximum efficiency in a compact footprint. The justification is even more clear when using Messenger, as one can track both part throughput and operational time to identify a machine's operational value.



Tim Tumanic
President, JR Machine

JR MACHINE FACTS

- + Founded in Shawano, WI in 1992
- + Contract manufacturer for OEMs and top-tier suppliers across a variety of industries
- + Wisconsin Manufacturer of the Year, 2018



JR Machine
1355 Beauprey Road
Shawano, WI 54166
www.jrmachine.com



DMP 70

The DMP 70 with a WH 3 Cell is notable for its compact footprint and high level of automation.

LEADING-EDGE TECHNOLOGY FROM DMG MORI FOR MORE QUALITY OF LIFE

SQ Products from Inwil near Lucerne in Switzerland has been successful in the market with its high-quality implants for endoprosthetics and surgical instruments since 1977. Today the company employs 70 highly skilled staff to fulfill the challenging requirements for top quality in the field of medical technology. The demand for high-quality implants and instruments made of titanium and stainless steel is on the rise – with 400,000 implant operations a year in Germany alone. This ensures above-average growth. For this reason SQ invested in its production and built a new, modern plant in 2019. The project included the installation of more innovative machine tools from DMG MORI. Shop floor capacity was expanded to include a DMP 70 with a WH 3 Cell in addition to the three NLX 2000 models and six NTX 2000 models.

Comprehensive expertise in medical technology

“As manufacturing processes in medical engineering have to undergo extensive validation, it takes a great deal of time to construct a new plant”, explains Markus Glaeske, CEO of SQ Products. That is why he has been building the new location while still running the existing production facility. “This meant we could continue to supply our customers without interruption and commence production seamlessly at the new location on conclusion of the validation process – with even higher capacity.” As an experienced supplier in the field of medical technology, SQ Products offers a comprehensive range of products and services: “On request we support our customers with consultations even in the early phase of development to work out optimum manufacturing strategies.” The focus is on feasibility and, of course, economical efficiency of production.

Endoprosthetics with implants for the shoulder, hip and extremities account for the largest part of turnover – a hip prosthesis, for example, lasts for around 15 years. Subsequent revisions introducing new implants are also routine today. Shoulder implants play a key role in everyday production at SQ Products. “Today, they are no longer simply modeled on the human shoulder joint (anatomical shoulder) but are often used as reverse shoulder,” Markus Glaeske says, describing the sophisticated implant. In the anatomically correct shoulder, the head of the joint sits on the humerus, and the socket lies on the shoulder joint. In reverse shoulder implants, the joint head is placed in the place of the bony socket, and the artificial socket rests on the upper arm. The procedure provides pain relief and the recovery of movement function to patients with functionally impaired muscles or degenerative joint changes.

»

Automated 5-axis simultaneous machining allows us to manufacture 24/7 and consequently remain competitive in the long term. We can thus achieve the quality we require for our components.

Markus Glaeske
CEO SQ Products



Leading-edge technology from DMG MORI for endoprosthesis

There is good reason for the high quality requirements and strict regulations in the medical sector says Markus Glaeske: "Every error constitutes a potential for personal harm." So it is important to deliver perfect, flawless products. "This requires leading-edge technology that offers accuracy and at the same time efficiency." SQ Products has found a partner in DMG MORI that fulfils these demands.

Lead-time of one day instead of several weeks

A good example of the increase in efficiency is the NTX 2000 turn-mill center. SQ Products has so drastically optimized production with them that lead-time for the sockets of a shoulder implant have been reduced from what often took several weeks to just one day. The component is extremely complex and profile tolerances are sometimes down to thousandths of a millimeter. A challenge that can be met with the NTX 2000, as Markus Glaeske can confirm: "With 6-sided complete machining we combine five process steps into one. We needed two to three machines for this before and, depending on capacity, some products had to wait longer." The NTX 2000 also benefits quality, of course, as repeated manual clamping can often lead to inaccuracies.

Thanks to its counter-spindle, the NLX 2000 can perform two-sided machining without the need for any manual reclamping. Eccentric machining is also part of the process that DMG MORI has designed in such a way that the service life of the tools is now significantly longer than it was with earlier techniques. "Several process steps were needed at that time and we had to change the inserts after four to five parts", recalls Markus Glaeske.

DMP 70 with WH 3 Cell:

Automatic, 5-axis simultaneous machining

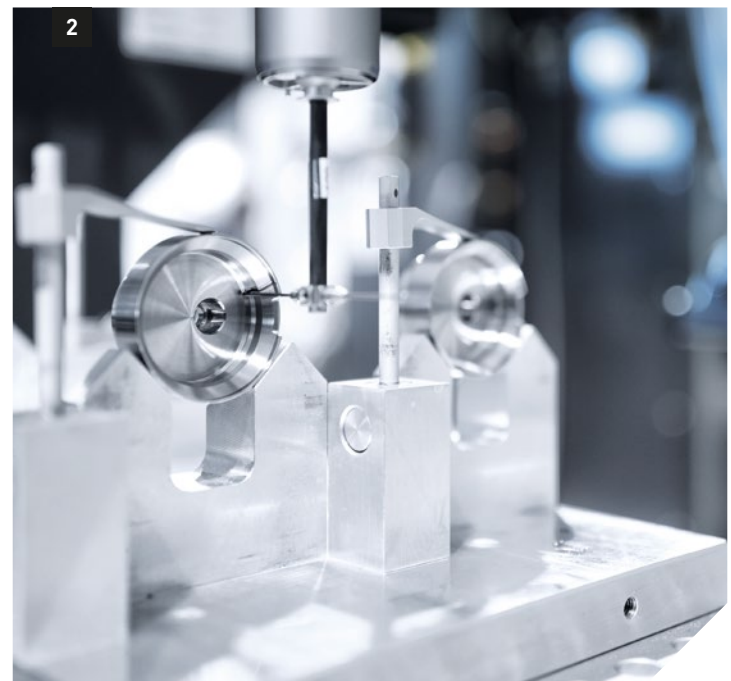
The latest arrival on the SQ Products shop floor is a DMP 70 with a WH 3 Cell automated workpiece handling system. According to Markus Glaeske, this was his first DMG MORI

24/7 5-AXIS MACHINING ON THE DMP 70 WITH WH 3 CELL

machine from Germany. What convinced him was its compact design and the extensive functionality: "Automatic 5-axis simultaneous machining was the deciding factor because we produce demanding shoulder stems on



Shoulder stems and sockets made of stainless steel are produced on the DMP 70 with WH 3 fully automatically 24/7 at SQ Products.



1. SQ Products has so drastically optimized production processes with its total of six NTX 2000 centers that throughput times for the sockets of a shoulder implant have been reduced from what often took several weeks to just one day. **2.** SQ Products meets the highest accuracy requirements during the production of medical implants.

6-sided complete machining combines five process steps in one work area. We used to need two to three machines for this and, depending on the utilization, had to leave individual products lying around idle for longer.

the DMP 70." Thanks to the workpiece handling system, this production is carried out ideally 24 hours a day, seven days a week – and all fully automatically. "The high level of automation is found throughout the entire factory – whether it involves bar loaders on the NTX models or robotic solutions such as the WH 3 Cell." High labor costs in Switzerland mean this is the only way SQ Products can remain competitive in the long term. "And we also achieve the required quality of our components in this way."

The DMP 70 also offers impressive speed in addition to being automated. Up to 2g acceleration, rapid traverses of 60 min/m and chip-to-chip times of 1.5 seconds guarantee maximum productivity. A 24,000 rpm inline spindle with up to 52 Nm, high-precision machine components and the rigid construction of the compact machining center

ensure high cutting performance and precision. Extensive cooling and linear scales are also part of the standard version.

Expansion of capacity and innovation were and are the main drivers for SQ Products as far as new investments for the shop floor are concerned. "We see DMG MORI in this respect as a competent partner that always finds the best solutions and provides us with optimum consultation", claims Markus Glaeske. "We will replace older machines in the future and then rely on the same level of support from the partnership."

SQ PRODUCTS AG FACTS

- + Founded in 1977
- + 70 skilled employees at the new location in Inwil, Switzerland, completed in 2019
- + Production of endoprosthesis implants and surgical instruments



SQ Products AG
Industriestrasse 23
6034 Inwil, Switzerland
www.sqproducts.ch





LOCAL PRODUCTION IN USA

DMG MORI DAVIS FULL-SERVICE FACTORY



Application Test Cuts

Rigorous Inspection

Precision Assembly

*From applications to installations,
the factory in Davis, CA supports the USA.
We pride ourselves on our transparency
with customers; come visit us and see for
yourself the care and attention that goes
into every detail of the machines we build.*

John McDonald
Executive Vice President
Davis Development & Product Department



Factory-Direct Installation

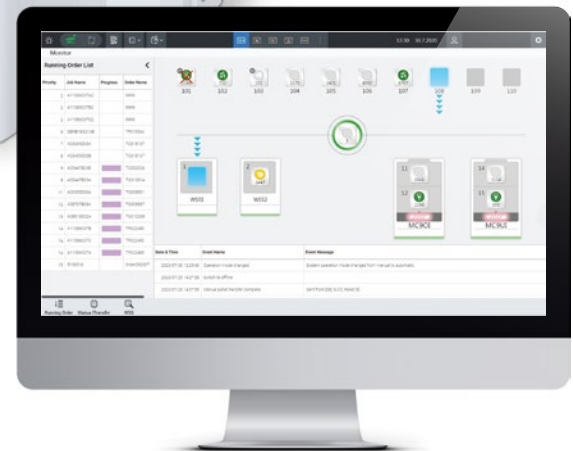


LPP 40

**NOW
MANUFACTURED
IN USA!**



**LINEAR
automation for
any shop**



**Access your pallet pool
from any mobile device!**



LPS 4



**INTUITIVE
TOUCH-BASED
LINEAR
PALLET
SOFTWARE**

AUTOMATED IN-HOUSE MANUFACTURING AS A FACTOR OF SUCCESS

Attabotics, Inc. from Calgary in Canada was launched onto the market in 2016 with the goal of developing and building robotic 3D storage. The main customers for the efficient and space-saving storage solutions are companies from the ever-expanding e-commerce sector. Attabotics has over 200 employees, who have developed an innovative and space-saving storage system. Their in-house manufacturing includes a fleet of ten machining centers from DMG MORI, including two DMU 50 3rd Generation. Like the robotic storage solutions, Attabotics relies on intelligent and economical solutions for manufacturing, which is why the 5-axis machines have been automated with WH 6 Cell workpiece handling.

Scalable automation solutions for online commerce

The growth in online commerce in recent years has led to a growing demand for intelligent storage solutions that can manage large order volumes quickly and efficiently. Based on these requirements, Attabotics has developed patented products and

solutions that offer high density storage and work with extremely fast robots. "Our three-dimensional storage systems reduce space requirements by up to 85 percent," explains Scott Gravelle, CEO Attabotics. "Our solutions are also freely scalable, which means that the storage capacity and flow of goods can be

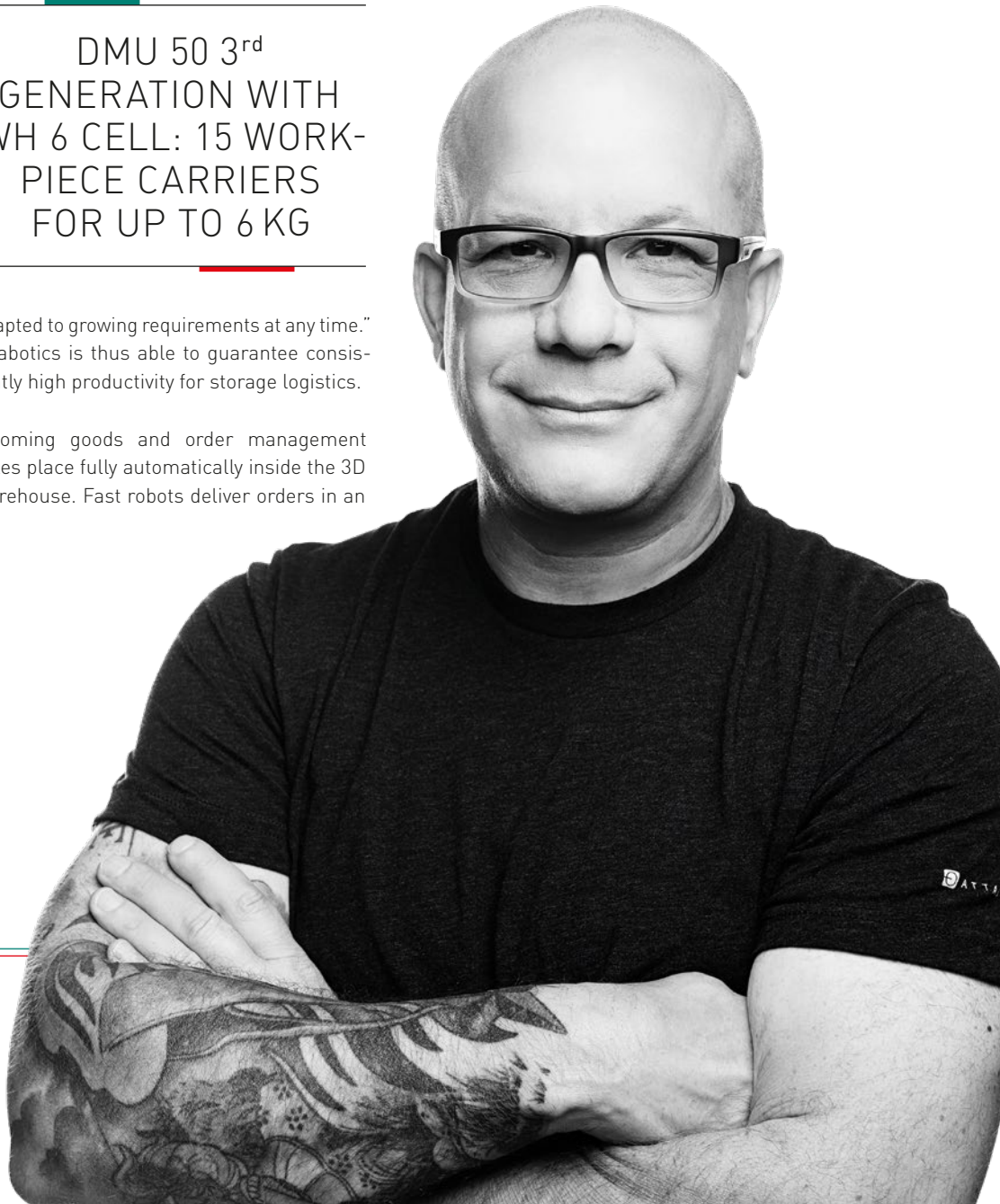
DMU 50 3rd
GENERATION WITH
WH 6 CELL: 15 WORK-
PIECE CARRIERS
FOR UP TO 6 KG

adapted to growing requirements at any time." Attabotics is thus able to guarantee consistently high productivity for storage logistics.

Incoming goods and order management takes place fully automatically inside the 3D warehouse. Fast robots deliver orders in an

We have found the right partner in DMG MORI to provide us with reliable 5-axis technology and automation directly from a single source.

Scott Gravelle
CEO Attabotics





The DMU 50 3rd Generation perfectly fulfills our high requirements for precision.

John Hickman
Vice President Manufacturing

efficient sequence, sort the goods and transport them reliably to the respective workstation. According to Scott Gravelle, "Fast installation and commissioning are possible and the system can also be expanded during running operations." Nordstrom, a US American e-commerce clothing company, is already using a 3D storage system from Attabotics to reduce its warehouse space, save real estate costs and accelerate logistics. "E-commerce companies like these are the ideal user as they almost exclusively need to transport smaller sized goods."

DMG MORI as a partner for automated 5-axis machining

The productivity that Attabotics guarantees for storage logistics is also needed by the company for its own manufacturing to ensure it remains competitive. Automation solutions that can handle increasing capacity are in demand. "Because we don't have

sufficient capacity to automate our own production, which in any case is not our core expertise, we needed an experienced partner in this area," recalls John Hickman, Vice President Manufacturing. They found the right partner in DMG MORI and installed two DMU 50 3rd Generation machines with WH 6 Cell workpiece handling.

WH 6 Cell –

Workpiece handling up to 6 kg

Amongst other things, Attabotics manufactures aluminum base columns on the two DMU 50 3rd Generation machines for supporting the framework of the 3D storage systems. "We always need large numbers of these parts," says John Hickman. "We needed to automate this manufacturing process, including workpiece handling, to be able to meet the high demand especially when production is at full capacity." WH 6 Cell workpiece handling is perfectly designed for this. The robots move

components with a workpiece weight of up to 6 kg and dimensions of 300×280×50 mm. 15 workpiece carriers are included.

From aluminum to steel – the DMU 50 3rd Generation as the foundation for 5-axis machining of key components

Very precise machining is required, as the base columns are also responsible for aligning the customer's entire storage system horizontally. "This was one of the requirements of the DMU 50 3rd Generation," says John Hickman looking back at the acquisition. Smaller components for the Attabot™ are also produced on the 5-axis machine. "Efficient machining of complex geometries with accuracies of up to 5 µm was a further requirement – both for stainless steel as well as aluminum workpieces." The machining flexibility of the DMU 50 3rd Generation was a decisive factor.

»



With automated production on the DMU 50 equipped with a WH 6 Cell, Attabotics meets the high demand for base columns and other components, even when at full production capacity.



1. Automated manufacturing allows Attabotics to meet its high demand for base columns and other components, even at full capacity. 2. The automated loading and unloading of the DMU 50 3rd Generation achieves high production capacity and more manufacturing flexibility.

Higher R&D capacity thanks to automated in-house manufacturing

The automated loading and unloading of the DMU 50 3rd Generation achieves high production capacity and more manufacturing flexibility. "We want to manufacture as many of our components as possible in-house, but at the same time we want to invest in research and development," says Scott Gravelle, outlining the challenge. Automated manufacturing offers this flexibility. "Particularly when it comes to the development of new products, we can perfectly draw on the expertise of our CNC team."

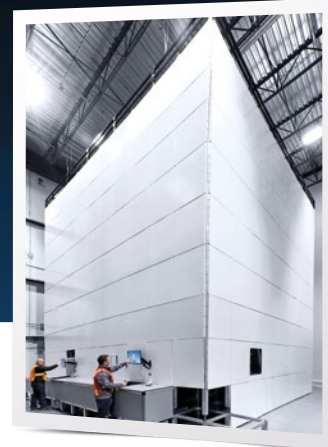
Automated production is one of the factors that enables Attabotics to offer a vertically oriented and comprehensive range of services, Scott Gravelle emphasizes: "They include research and development, design and actual production including CNC machining, robotic assembly and testing of the products." Installation and commissioning of the 3D storage system at the customer's site rounds off the offer. Attabotics thus supplies everything from a single source, which also applies to DMG MORI in the area of automated manufacturing.

Expansion with automated 5-axis technology from DMG MORI

In addition to the six storage solutions installed in North America so far, other companies from a range of industries are testing Attabotics' 3D storage platform. Scott Gravelle looks ahead optimistically: "As we are also able to cool our 3D storage, the system is also applicable to the food industry." Deep-freeze solutions with end-to-end cooling are also under development. "This means the signs are good that we will soon be able to drastically increase our production output." Existing production could be expanded by WH 6 workpiece handling in the future to achieve this: "Automated 5-axis machining centers such as the DMU 50 3rd Generation or the compact DMP 70 could also ensure efficient manufacturing in this area."

«

The Attabots from Attabotics travel three dimensionally through the space-saving storage system.



The innovative and space-saving storage system from Attabotics reduces space requirements by up to 85 percent and is freely scalable. Attabotics has industry leading storage density all in one small footprint, moving goods three dimensionally through the storage system – including refrigerated goods and even, in the future, frozen goods with an end-to-end cool chain.

ATTABOTICS FACTS

- + Founded in Calgary, Canada in 2016
- + Over 200 employees
- + Development and construction of robotic 3D storage systems
- + Target customers include e-commerce companies in particular



Attabotics Inc.
7944 10th Street NE
Calgary, AB T2E 8W1, Canada
www.atabotics.com



WH CELL

MODULAR WORKPIECE AUTOMATION

- + **Modular automation system** for workpieces up to 25 kg (3, 6, 8, 15, 25 kg)
- + **Conveyor or drawer workpiece storage:** max. workpiece size of 300 × 300 × 220 mm; max. load capacity of 250 kg
- + **KUKA/FANUC INDUSTRIAL ROBOTS with different gripper variants from SCHUNK:** Single or double gripper including customer-specific gripper jaws
- + **Expansion** (optional): SPC drawer, NOK chute, blow-off device, turnover station and much more



NOW AVAILABLE
FOR ADDITIONAL
MACHINES!

SINGLE-
SOURCE
SOLUTIONS
FROM
DMG MORI!



PH 150

BOOST YOUR PRODUCTIVITY WITH
THE PH 150 PALLET HANDLING SYSTEM
FROM DMG MORI

- + PH 150 is operated directly from machine control panel – no separate panel for the automation!
- + User-friendly and easy to understand interface
- + Large variety of available configurations starting from 24 round pallets $\varnothing 148$ mm up to four 500×500 mm pallets
- + Handling capacity up to 150 kg as standard (extension to 250 kg optional)
- + Possibility to prioritize jobs
- + EROWA clamping system
- + High clamping repeatability of pallets (< 0.002 mm for EROWA chuck UPC-P)
- + Flexibility – can be integrated with a wide range of DMG MORI machines
- + Optimal machine and automation system accessibility

CMX U series


DMU 50
3rd Generation


DMC V series


DMU 65/75
monoBLOCK


CMX V series



DMU eVo series

	Power Chuck 24 pallets, ø 148 mm	Production Chuck 12 pallets, ø 210 mm	UPC-P 10 pallets, 320×320 mm	MTS 6 pallets, 400×400 mm	MTS 4 pallets, 500×500 mm
CMX V, DMC V	•	•	•	•	•
CMX 50 U	•	•	•	•	•
CMX 70 U	•	•	•	•	•
DMU 50 3 rd Generation ¹	•	•	•	•	•
DMU 65/75 monoBLOCK ²	•	•	•	•	•
DMU 40 eVo	•	•	•	•	•
DMU 60/80 eVo*	•	•	•	•	•
HSC 55 <i>linear</i>	• ²	• ²	• ²	•	•

¹Also for ULTRASONIC variants, ²On request

COMPETITIVE PRICES THANKS TO WORKPIECE HANDLING

WTE Präzisionstechnik from Ehrenfriedersdorf started producing precision drill chucks in 1999 with just 12 employees. Since then the number has increased to 170 employees. Continuous development and integration into the international MAPAL Group in 2008 have helped the company grow into a renowned partner for clamping technology. Today, MAPAL's clamping technology competence center relies on machine tools from DMG MORI, 17 machines in total. As recently as 2019 three new turning centers were installed to expand capacity: an NZX 2000 and an NLX 2500, which operates automatically via a gantry loader and an NLX 2000 with bar loader.

"The innovative clamping technology of WTE Präzisionstechnik was a decisive factor for its integration into the MAPAL Group", recalls Ralf Wackenhut, at the time of the interview Managing Director of WTE Präzisionstechnik GmbH, today head of the Digital Operations division at the headquarters of Mapal Group in Aalen: "This allowed us to complete the product portfolio and position ourselves as a full-service provider in the market." WTE Präzisionstechnik produces many different chucks, drill chucks and shrink fit chucks for both key MAPAL customers as well as for the trade. "On one hand this means production quantities for the trade are easy to plan and

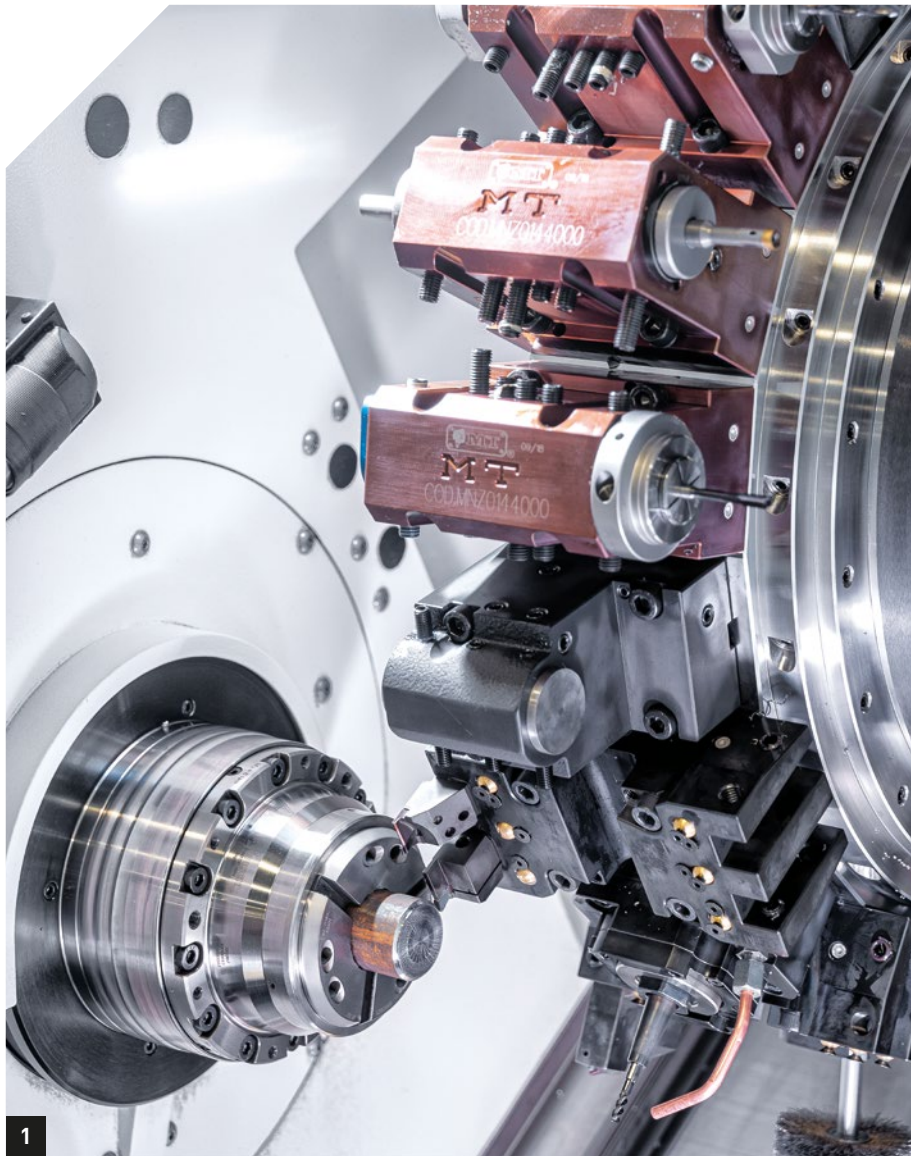
on the other we have to be able to respond flexibly to short lead-time orders directly from customers."

Intelligent processes are necessary for flexibility in production

Ralf Wackenhut sees maintaining quality-oriented production, despite these flexible demands, as the main challenge: "Intelligent processes are the key", he claims. With machining centers and turning machines from DMG MORI, WTE Präzisionstechnik already achieves final contour dimensions to DIN standard of less than five µm when machining materials in their soft state.

*Thanks to the automated
NLX and NZX we can now
handle last-minute requests
promptly. And achieve even
higher quality.*

Graduate engineer (FH), MBA
Ralf Wackenhut



"Growth during hardening is calculated in such a way that post-processing is reduced to a minimum."

OPTIMUM CAPACITY UTILIZATION THANKS TO FLEXIBLE AUTOMATION SOLUTIONS

GX 10 T – Multiple machine operation and unmanned shifts thanks to modern automation solutions from DMG MORI

Ralf Wackenhut sees additional process optimization in automation: "For the most part we produce batch sizes of 100 parts, so automated processes have a great rationalization

effect, especially during unmanned shifts at night and the weekend." Multiple machine operation is also a key factor. The NZX 2000 and NLX 2500 purchased in 2019 are each equipped with a GX 10 T gantry loader, which both loads the machines and removes and deposits the finished parts. Workpiece dimensions of 2 times $\varnothing 200 \times 150$ mm, each gripper capable of carrying 10 kg, are ideal for our requirements. While the NZX 2000 with three turrets and three Y-axes machines the complex face of the body, the NLX 2500 is responsible for the comparatively faster machining of the taper at the rear. "To exploit free capacity to the full, we also use the two automated machines for high-precision finishing of workpieces from other machines," explains Ralf Wackenhut. All the operator has to do is push a magazine containing pre-machined workpieces into the automation system.

Where automation is concerned WTE Präzisionstechnik relies on standard machines and standard components. Thanks to the collaboration with DMG MORI, we get our machines and automation from a single source. Always perfectly coordinated: "Firstly the gantry loaders are quite simply proven and secondly this makes designing and procuring the systems easier."

»

1. Use of driven tools from MT Marchetti on the NLX 2000. 2. WTE Präzisionstechnik produces parts from bar mainly automatically on the NLX 2000 with bar loader. 3. The NZX 2000 and NLX 2500 purchased in 2019 are both equipped with a GX 10 T gantry loader.



This is also true of the NLX 2000 with bar loader: "The two gantry solutions are used exclusively for finishing pre-machined workpieces. We then have the option of machining parts from bar for the most part automatically on the smaller NLX 2000 with bar loader.

**40 % reduction in throughput times
due to turning and milling in one clamping**

In view of the complex chucks that WTE Präzisionstechnik produces, the versatile machining options of the turning centers – i.e. turning and sophisticated milling operations in a single clamping – were decisive for Ralf Wackenhut. The direct-drive, powerful BMT turret rotates cutters at up to 10,000 rpm. "Formerly we needed several process steps on different machines for both front- and reverse-end machining. Achieving this on just two machines has led to a 40 % reduction in throughput times, which in turn has had a favorable impact on the speed of our response. Fewer clampings mean that rejects almost only occur due to tool wear. We could, of course, machine the workpieces completely on all 6 sides on the machines – however, we decided on a sequential process instead to ensure better utilization of machine capacity."

Ralf Wackenhut is optimistic that WTE Präzisionstechnik will continue to grow in the future: "We have sufficient space available and can find good skilled workers when we need them. Or we train them ourselves." The company takes on three to four trainees a year. "They include more and more women", says the managing director, clearly pleased with the interest shown by female applicants in technical professions.

**Fit for the future – Additive manufacturing
produces new products for tool clamping**

Ralf Wackenhut also looks to the future where technology is concerned. "We see great potential in additive manufacturing", he says, with reference to the LASERTEC *SLM* machines from DMG MORI. One example of this is WTE Präzisionstechnik's innovative hydraulic clamping technology. Hydraulic chucks have internal channels in which oil is used to build up pressure to clamp the tool. The technology damps vibrations, ensures high concentricity and requires very low maintenance. The small hydraulic chucks cannot be produced by conventional methods due to the extremely fine channels: "There is no alternative to powder bed additive manufacturing in this case. That is why we contacted DMG MORI."

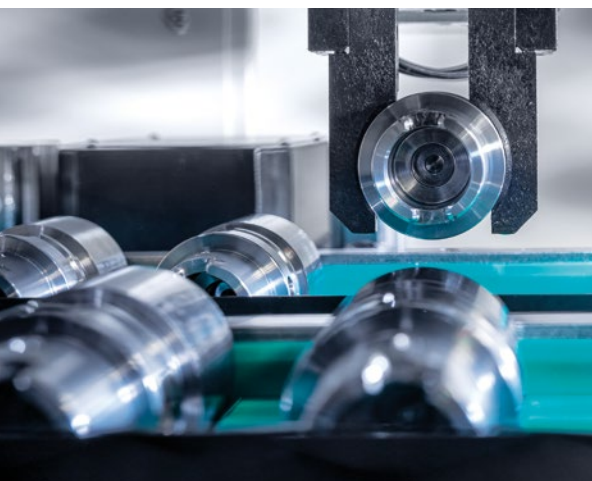


WTE Präzisionstechnik produces the sophisticated chucks in batch sizes of 100.

**MAPAL KOMPETENZ-
ZENTRUM SPANNTECHNIK /
WTE PRÄZISIONSTECHNIK –
FACTS**

- + Founded in Ehrenfriedersdorf in 1999
- + Integrated into the international MAPAL Group in 2008
- + 170 employees
- + Production of high-quality, precision chucks
- + Competence center for clamping technology

WTE Präzisionstechnik GmbH
Gewerbegebiet an der B95, 2a
09427 Ehrenfriedersdorf
Germany
www.wte-tools.de



The gantry loaders handle workpieces into the respective machine, then remove and deposit the finished parts.

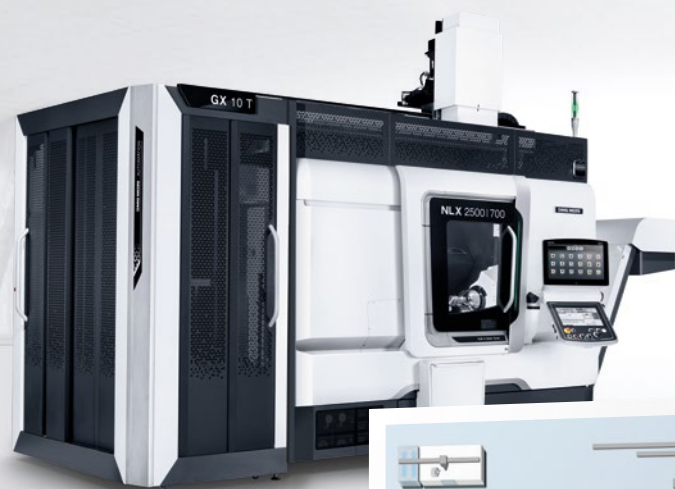


The two GX 10 T gantry loaders serving the NZX 2000 and NLX 2500 and the bar loader of the NLX 2000 enable efficient multiple machine operation.

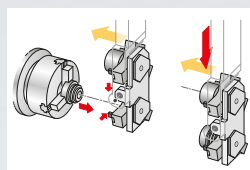
GX AND GX T

MODULAR GANTRY LOADING SYSTEM

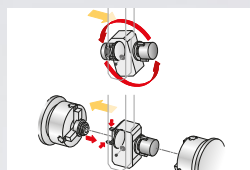
- + Automation of a machine
- + Linking of several machines



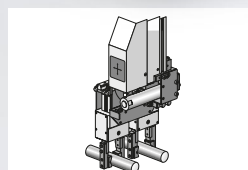
GRIPPERS



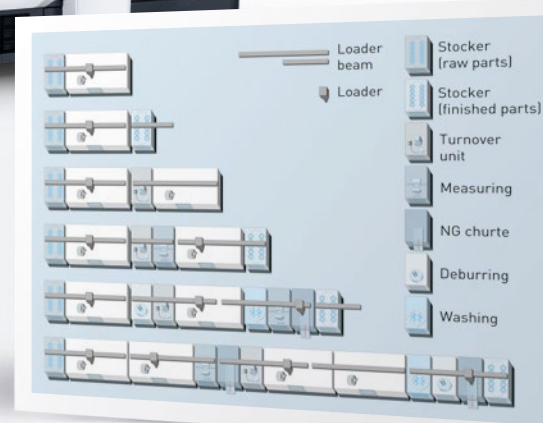
Double gripper for main spindle



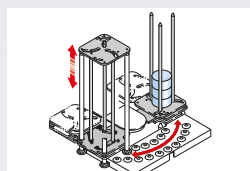
Double gripper for main and counter spindle



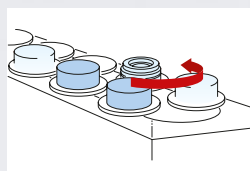
Double gripper for shafts



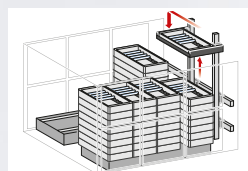
WORKPIECE STORAGE



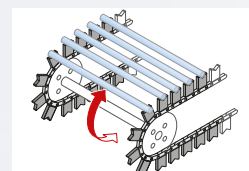
Stacking magazine for round, tubular or multi-sided material



Magazine for irregularly shaped workpieces



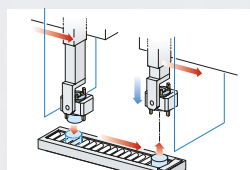
Rack stacking magazine



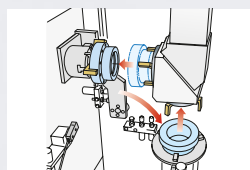
Shaft storage

Examples of interlinking and modules

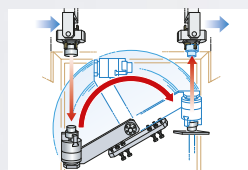
PERIPHERALS



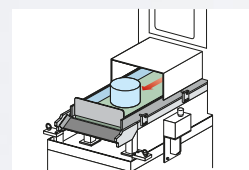
Transfer unit



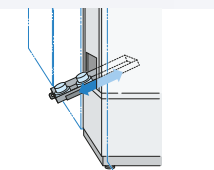
Loading unit



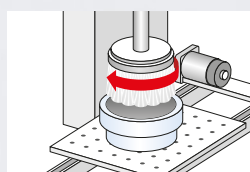
Transfer and tilt device



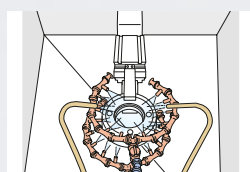
Loading and unloading belt



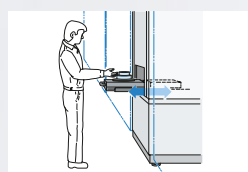
NG chute



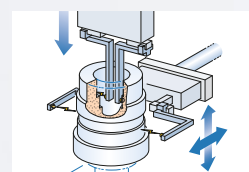
Deburring



Blowing off



Quality control



Metrology



3D measuring

AVAILABLE FOR 12 MACHINE SERIES WITH OVER 40 VARIANTS

	GX 3	GX 5	GX 5 T	GX 6	GX 7	GX 10 T	GX 15	GX 15 T	GX 35 T	GX 60 T
Max. workpiece weight (kg)	2×3	2×5	2×5	2×6	2×7	2×10	2×15	2×15	2×35	2×60
Max. workpiece size (mm)	ø 150×100	ø 150×120	ø 150×120	ø 180×140	ø 150×120	ø 200×150	ø 200×150	ø 200×150	ø 315×300	ø 450×500
Max. number of pallet stations	14/20/26	14/20/26	14/20/26	10	14/20/26	10/20	10/20	10	15/24/40	12/24/40
Product overview	NRX 2000	NLX 1500, 2000	NZX-S	CLX 350	ALX	NLX 2500	ALX	CTX 2500/700	CTX beta 4A	CTX beta 2000 TC
		NLX 2500/500	NZX 1500/800			NTX 1000 – 3000			CTX beta TC 4A	CTX gamma TC
		NLX 2500/700	NZX 2000/800			NZX 1500, 2000				
						NZX 2500				

AUTOMATED ONE-OFF AND SMALL BATCH PRODUCTION

As a full service provider in toolmaking, Top Grade Molds, Ltd., founded in 1964, provides its customers with comprehensive support from initial development to the final tool tryout. Injection molds for rigid plastic packaging, for example as used in the food industry, is the core business. The Canadian company from Mississauga, Ontario (near Toronto), employs 150 well-trained specialists to meet the high quality standards of the industry. Top Grade Molds meets the precision requirements with modern machine tools from DMG MORI. Since 2011, the company has installed 13 models from the machine tool manufacturer, including several duoBLOCK machines and one NHX 10000, as well as four NHX 5000, which are highly automated with the help of two linear pallet pools (LPP) – which increased the productivity of Top Grade Molds literally overnight.

“As a manufacturing service provider in tool and mold making, we machine one-offs and small batches,” Vince Ciccone, President and CEO of Top Grade Molds, explains when describing the day-to-day production. Co-operation with customers often begins in the product development phase. In order to remain competitive, he says, it is necessary to react flexibly and implement efficient production. “Turning and milling constitute by far the largest share of machining at 80 percent. In DMG MORI, we have found a real partner in this field.”

Uniform control and production technology from DMG MORI

There were two main reasons why Top Grade Molds started investing in machine tools from DMG MORI in 2011. On the one hand, the wide product range offers suitable manufacturing solutions for almost every application. Vince Ciccone says: “On the other hand, we wanted to establish a consistent control system.”

Independent of the underlying control system, CELOS offers a uniform and clear interface. “This makes training on new machines much easier.” The range of different jobs fulfilled by the DMG MORI models is also an important factor: “We always have new orders and often set up the machines anew. Large tool magazines and good accessibility also give us the necessary flexibility.”

AUTOMATED AND FLEXIBLE

NHX and duoBLOCK – process reliability in tool and mold making

Vince Ciccone sees the key to optimum production in machining the demanding high-precision components for injection molds with the required precision and,



We are constantly looking for innovative solutions to optimize our processes and open up new markets. With DMG MORI we have found the ideal partner for this.

Vince Ciccone
President and CEO
of Top Grade Molds



Included in Top Grade Molds' fleet of machines are four NHX 5000s, which operate automatically with two linear pallet pools.

above all, productively: "The rigidity and high repeatability of the DMG MORI machines are the perfect basis for this." It is why the stable duoBLOCK machining centers and NHX models were chosen. In 2019, one NHX 10000 and two NHX 5000 – in addition to the two existing NHX 5000 – were purchased. The inherently rigid machine bed, the stepped moving column in the x-axis and 70 mm spindle bearing diameter give the horizontal machining centers the rigidity required for precise machining. Linear scales with 0.01 µm resolution are also included.

Automated through the night

With a table load of 700 kg and a working volume of 730 × 730 × 880 mm, the NHX 5000 covers a wide range of parts so that Top Grade Molds can respond well to the constantly changing orders. As this is the case, production had to be automated, as Vince Ciccone recalls: "Of course, the aim was to

increase capacity with automation." Two of the NHX 5000 machines are equipped with a linear pallet pool. "But equally important was the flexibility to produce one-offs and small batches automatically." The LPP installed by DMG MORI has 20 pallets, each measuring 500 × 500 mm, and a set-up station. Tool management is also integrated into the two automation solutions, so that a total of 120 tools are available per LPP. "This allows us to keep the machines working all night without any problems."

NHX 10000: Horizontal machining up to 5,000 kg workpiece weight

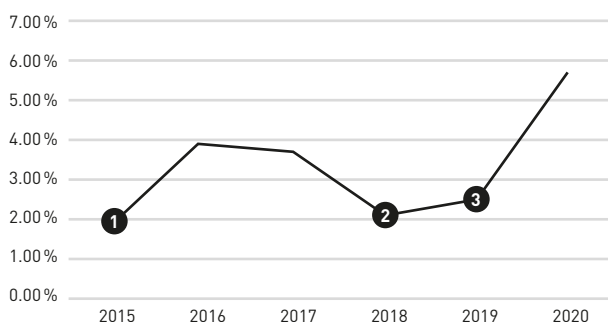
Top Grade Molds has expanded its large part machining capacity with the NHX 10000. Travels are 1,700 × 1,400 × 1,510 mm and the table can take a load of up to 5,000 kg. The XXL horizontal machining center is made for high performance machining. The spindle has a maximum power of 40 kW and 1,413 Nm torque. The

drive along the center of gravity and the overhang-free design allow for vibration-free and precise machining.

Vince Ciccone appreciates the long-standing cooperation with DMG MORI, because the machine tool manufacturer now knows the requirements of Top Grade Molds: "They can anticipate very precisely which manufacturing solution will move us forward. We are in a growth phase and are constantly looking for innovative solutions to optimize our processes and open up new markets."

«

CONTINUOUSLY GROWING ANNUAL PRODUCTIVITY GROWTH



1. New 5-axis machines
2. LPP with 2 × NHX 5000
3. LPP with 2 × NHX 5000

TOP GRADE MOLDS LTD. FACTS

- + Founded in 1964
- + 150 employees and 11,200 m² factory space
- + Designs and produces high-quality plastic injection molds for the world's leading manufacturers of industrial and thin-wall packaging
- + Designed with balanced cooling channels and hot runners as well as for ease of maintenance and long service life



Top Grade Molds Ltd.
929 Pantera Drive
Mississauga, ON, Canada
www.topgrademolds.com





80 % HIGHER VOLUMETRIC ACCURACY

Productivity and precision are a key part of DMG MORI'S DNA. Why this is so and the relevance of **μPrecision** and VCS Complete are explained by Christian Thönes, Chairman of the Board of DMG MORI AKTIENGESELLSCHAFT, and Alfred Geißler, Managing Director of DECKEL MAHO Pfronten.

Mr. Thönes, what does precision mean for DMG MORI?

Thönes: Productivity and precision are a key part of DMG MORI'S DNA. We always strive for maximum quality and precision with maximum conservation of resources. And we live up to this claim – as is shown not least in the sustained success that has made us a leading manufacturer in the machine tool sector.

Where does precision begin for you and how, in your view, is DMG MORI positioned in the area of precision?

Thönes: I see accuracy not only in relation to products and production, but holistically.

Precision is essential in all our corporate divisions. One main reason for our lasting success is precision in the overall process of the machine, in the process chain within our daily business and in customer projects. The innate high precision of the duoBLOCK and Portal machine series serves as the basis

PRODUCTIVITY AND ACCURACY IS IN OUR DNA

for this **μPrecision** package. These machines have a rigid construction, are thermo-symmetrically designed and are manufactured and installed with the highest precision. The already extensive cooling in the standard version of the machines has been extended to include numerous additional measures.

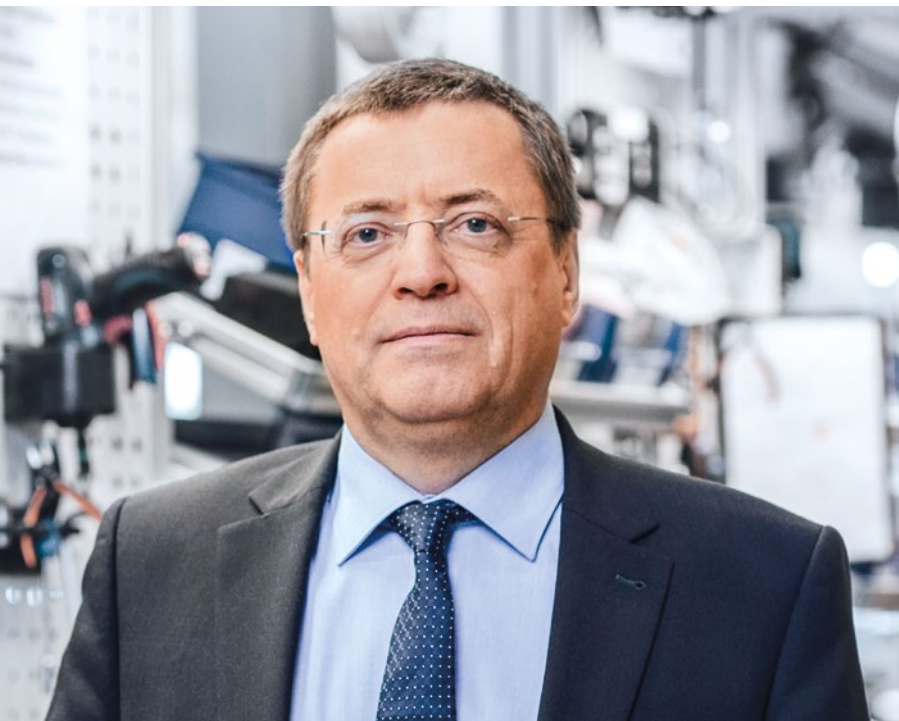
Further cooling measures, the Thermoshield and coolant temperature control are used as far as the hardware is concerned. This is further refined with accurately adjusted linear guideways and a volumetric calibration system.

What does the optional **μPrecision program package consist of?**

Thönes: The **μPrecision** feature for milling machines includes further optimizations of the hardware. While until recently the support for the guideways was scraped by hand – a process that took over 500 hours – this is now achieved using shims. Their positioning is simulated with the aid of software to enable precise mounting. This results in flatness and straightness of the linear guideways of less than 3 μm.

What other features does the **μPrecision option offer?**

Geißler: Temperature control of the coolant and lubricant are part of the **μPrecision**



Thanks to the optimization the **μPrecision** machines operate up to 80 percent more accurately than the same machines without the option package.

Alfred Geißler
Managing Director
DECKEL MAHO Pfronten GmbH

offer. This stabilizes the temperature of the machine and workpiece, thus reducing temperature-related expansion. The resolution of the concentricity measurement system is now almost three times higher. A third part of the hardware optimization is the "Spindle Growth Sensor". This measures and compensates every temperature-related spindle movement in real-time.

And what about the software?

Geißler: As far as software is concerned, every **μPrecision** machine is equipped with individual thermal compensation. Before delivery to the customer, we calculate how the machine behaves under changing conditions. The resulting data are saved in a dataset from where they are called up continuously during the machining process. This happens in sync with the PLC control, in other words about every 50 milliseconds.

What benefits do the **μPrecision** machines offer for customers?

Geißler: Thanks to the optimizations, the **μPrecision** machines operate up to 80 percent more accurately than the same machines without this option package.

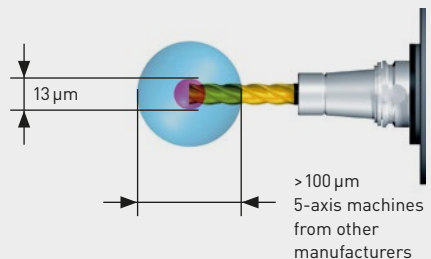
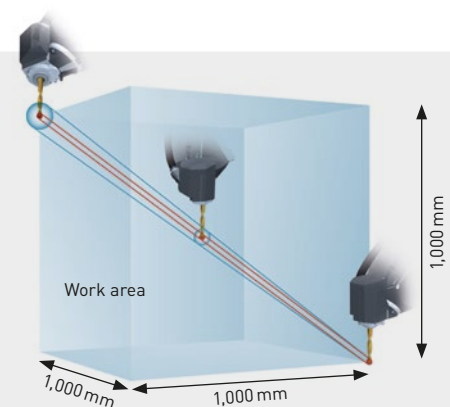
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μPrecision SERIES

- + Finely adjusted linear guideways X/Y/Z for maximum geometric precision (flatness and straightness $\leq 3\mu\text{m}$)
- + All features of the accuracy package
- + Volumetric measurement with compensation of the machine's working area
- + Coolant system with temperature control
- + Machine Protection Control (MPC)
- + BLUM tool measurement
- + Individual temperature compensation including spindle growth sensor (SGS)
- + High-precision measuring probe OMP 600



13 μm volumetric accuracy



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

		DMU/DMC 80 μPrecision	DMU/DMC 125 μPrecision	DMU/DMC 160 μPrecision	DMU/DMC 210 μPrecision	DMU/DMC 270 μPrecision	DMU/DMC 340 μPrecision
Volumetric accuracy	μm	13	15	20	20	25	30
Max. travel (X)	mm	800	1,250	1,600	2,100	2,700	3,400
Positional uncertainty (X/Y/Z) according to ISO 230-2	μm	3/3/3	4/3/4	4/4/4	4/4/4	6/6/6	8/9/8
Positional uncertainty (B/C) according to ISO 230-2	ws	4/4	4/4	4/4	4/4	4/4	4/4

What accuracy can be achieved with the μ Precision program package?

Geißler: With μ Precision we achieve positioning accuracy down to $3\mu\text{m}$ and a volumetric accuracy of less than $13\mu\text{m}$ throughout the entire work area. The achievable accuracies on the workpiece can be even further enhanced and stabilized by our Tool Control Center (TCC). Highlights of TCC include chip detection on the face and taper and monitoring of the drawbar clamping force. Cutting edge control in-process by monitoring the symmetry of the bending moment per cutting edge and visualization of the bending moment over time via a graph are additional features of TCC worth mentioning.

What accuracy do the respective DMG MORI machines achieve without μ Precision?

Thönes: Without μ Precision the DMU 80 P duoBLOCK achieves a positioning accuracy in the linear axes of $5\mu\text{m}$ instead of down to $3\mu\text{m}$ with μ Precision. In the case of the DMU 340 P, positioning accuracy is $15\mu\text{m}$ without μ Precision in the linear axes, that is 80 percent more than with μ Precision.

In which sectors is maximum precision important?

Thönes: The level of precision that we offer at DMG MORI is required especially in the aerospace industry, for landing gear and turbine parts, for example, as well as in mechanical engineering for high-precision wafer fixtures and the like. The die & mold and the semiconductor industries are also among our target groups. μ Precision is available for the duoBLOCK and Portal series, i.e. in all 5-axis machines in the sizes from 800 mm to 3.4 meters.

Why doesn't the competition have anything comparable?

Thönes: Competitors could in fact purchase the hardware components. But the highlight and know-how lies in the finely tuned kinematics and the compensation tables. This is where we have the requisite expertise that the competition simply does not have to such an extent.

What is the additional cost of the option?

Thönes: The additional cost depends on the size of the machine, its configuration and the requirements of the customer. Depending on the equipment package, the price starts from around 180,000 Euros.

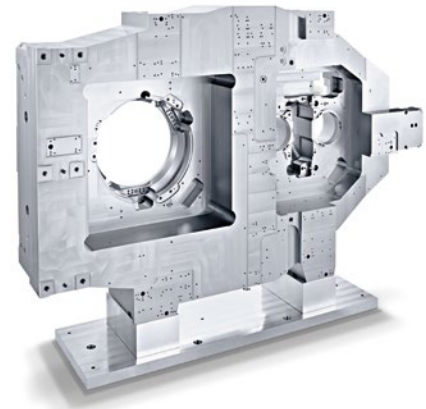
The technology cycle for volumetric accuracy, VCS Complete, also offers an advantage in precision ...

Thönes: and VCS Complete is far less expensive than the μ Precision package. This technology cycle only costs around 12,200 \$. The investment in this feature amortizes within a year. In the event of a collision, the geometry of the machine can be checked simply and independently and if necessary compensated again. Service technicians no longer need to take the machine out of operation for up to three days and recalibrate it. Calibration using VCS Complete takes less than an hour. The process can be carried out at short notice – if parts with especially high quality requirements are to be produced, for example. The machine operator needs no special training.

Brief instruction during commissioning and the touch of a button are all it takes. Whoever buys this option boosts productivity while saving time and money at the same time.

What makes VCS Complete so special?

Geißler: VCS Complete detects volumetric deviations in the work area and compensates for them to ensure higher accuracy over the entire service life of the machine. An inserted measuring probe identifies 180 different positions and compares them with theoretical target positions. This results in a best-fit comprising linear scale compensation, diagonal compensation and optimization of the kinematics, in other words correction of the distance between the spindle and the machine table. Put simply: The machine calibrates itself – in all axes.



SEMICONDUCTOR INDUSTRY
FRAME FOR LITHOGRAPHY SYSTEM

Material: high-strength aluminum mold and position tolerances $<10\mu\text{m}$
Material: tool steel
Texture: honeycomb structure



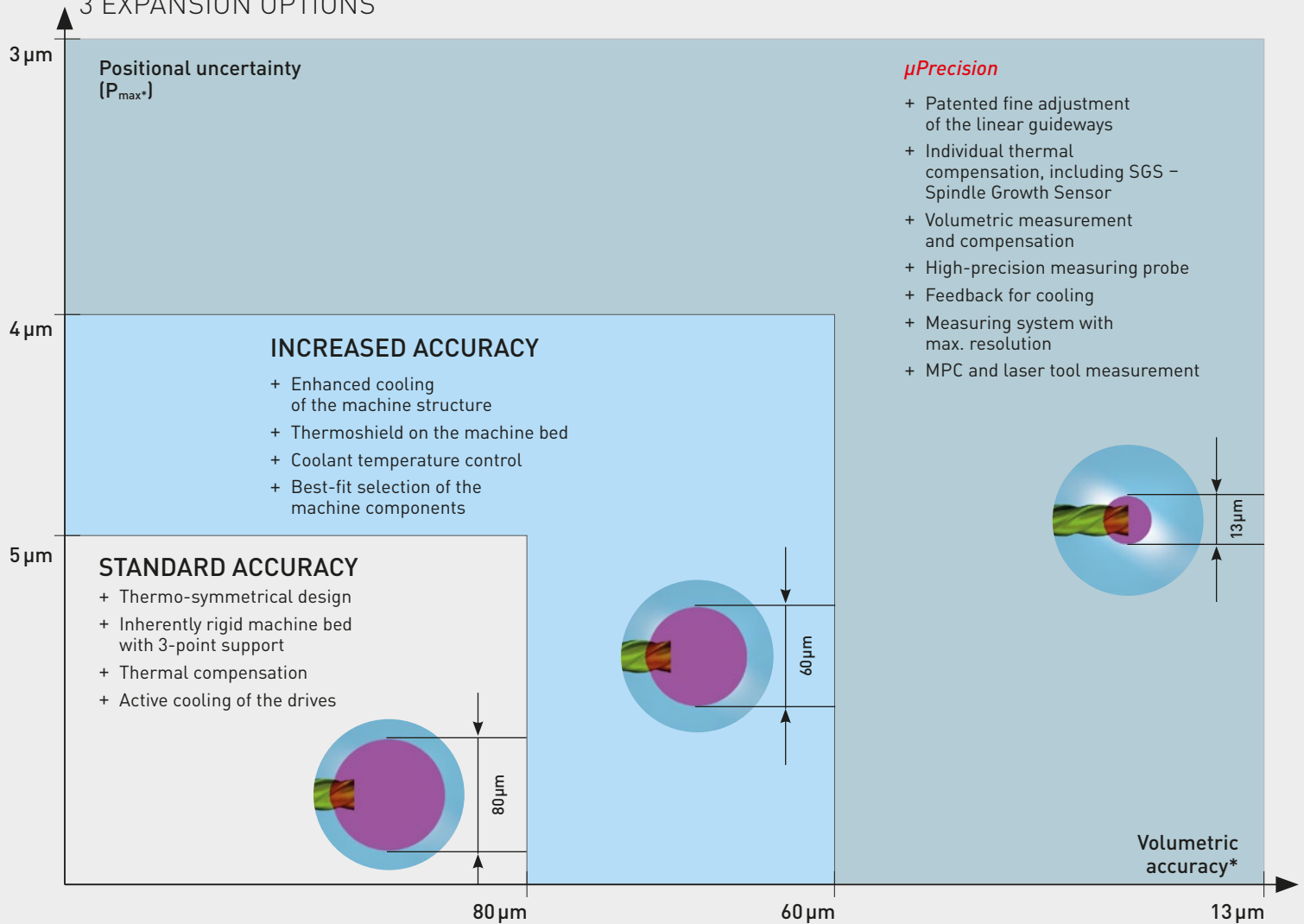
DIE & MOLD / AUTOMOTIVE
PLASTIC INJECTION MOLD FOR A RADIATOR GRILL

Material: tool steel
Position tolerances: $10 - 15\mu\text{m}$

Productivity and precision are a key part of DMG MORI'S DNA. We always strive for maximum quality and precision with optimum conservation of resources.

Christian Thönes
Chairman of the Board of
DMG MORI AKTIENGESELLSCHAFT

PRECISION DEFINED DOWN TO A MICRON – 3 EXPANSION OPTIONS



*All values based on the DMU 80 P duoBLOCK // μ Precision available for the duoBLOCK and Portal series (the specified installation and ambient conditions must be observed to achieve the accuracy values)

Which machines can the system be used on and which controls is it compatible with?

Geißler: The system is already available for the monoBLOCK and duoBLOCK series. It will also be available for the Portal series later this year. The medium-term aim is to make VCS Complete available for all standard DMG MORI machines. VCS Complete runs on CELOS machines and with the SIEMENS and HEIDENHAIN controls.

How do deviations happen during operation of the machine?

Geißler: On one hand quite simply from wear of the moving components, due also to the

interaction of these components with each other. On the other hand, deviations occur during collision of the tool caused by operating errors. A third reason can be a change in the ambient temperature if this is not compensated.

How long does a cycle take?

Thönes: A quick measurement for verification takes about ten minutes, while a complete measuring cycle including update of the compensation tables takes around 40 minutes. A check should be carried out before every machining operation with special accuracy requirements or when changing shifts, but no later than every six months.

How much does this "Technology Cycle" cost?

Thönes: As already mentioned, the price is around 10,000 Euros. The technology cycle including measuring kit costs 12,200 \$ in Germany, without the measuring kit 7,260 \$.

What is the main difference with 3D quickSET?

Geißler: As an entry-level solution, 3D quickSET offers fast calibration of the rotary axes and this technology cycle enables clamping of the component on the table.

This interview is based on a talk held by Mr. Thönes and Mr. Geißler with the magazine VDI Nachrichten.

«

RELIABLE AND ACCURATE TO WITHIN MICRONS THANKS TO VCS COMPLETE



Thanks to VCS Complete I was able to produce the die for a bevel gear to gear quality 1 to fulfill a customer order. And at the first attempt using 5-axis simultaneous machining.

Torsten Heil
Managing Director
CNC-Technik Heil GmbH

Complex precision components are the specialty of CNC-Technik Heil GmbH from Remscheid, which was founded in 2018. Customers from general mechanical engineering, motor sport and aviation trust in the expertise of the managing director Torsten Heil and his team. The company produces prototypes and small batches of sophisticated workpieces made of aluminum, stainless steel, cast-iron and Inconel on two DMU monoBLOCK machines in a fully air-conditioned hall. CNC-Technik Heil achieves this high level of precision with the aid of the DMG MORI Technology Cycle VCS Complete to calibrate the volumetric accuracy.

High-precision prototype production thanks to monoBLOCK machines

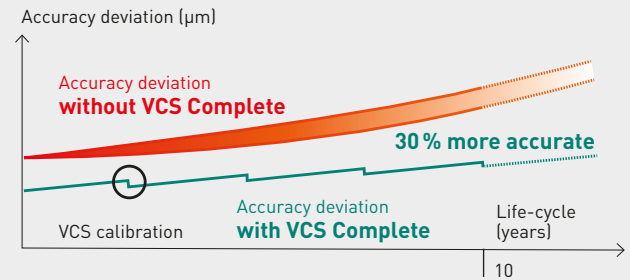
"The challenge for us lies in the programming of complex geometries and, of course, in the tight tolerances", says Torsten Heil about his day-to-day production. Using their experience and machining competence, he and his team produce high-quality components and support their customers with advice when they see potential for optimizing production. Another fundamental for high machining quality is the use of the latest CNC technology – in this case in the form of two DMU monoBLOCK machining centers.

DMU monoBLOCK: High-precision 5-axis simultaneous machining

Since 2007, when he started working for himself, Torsten Heil has bought 14 machining centers from the Pfronten plant. He was won over in particular by the DMU monoBLOCK models: "The machine concept allows optimum utilization of the work area and the simple kinematics based on a swivelling rotary table simplify programming of 5-axis simultaneous cycles." The sturdy construction of the monoBLOCK machines, comprehensive cooling and direct drive in the C-axis all contribute to guaranteeing a high level of consistent long-term accuracy. The DMU75 monoBLOCK and DMU95 monoBLOCK have provided clear proof of this since their installation in 2018.

VCS COMPLETE

- + Up to **30 % higher machining accuracy** over the entire life cycle
- + **Simple compensation** of the machine geometry
- + **Conversational software** for fast and simple operation
- + **Data recording** for further analyses and documentation of the measured results
- + **Compensation of deviations**, e.g. due to wear or collision



These two machines cover the wide range of component sizes produced by the company: impellers with diameters up to 600mm, machine parts and other components, which are milled from solid more often nowadays. "This means we deliver small batch sizes quickly and economically." Large tool magazines offer sufficient pockets for all standard tools, so setup times are reduced to a minimum, even with constantly changing parts.

Exclusive DMG MORI Technology Cycles

CNC-Technik Heil achieves extra precision with the exclusive DMG MORI Technology Cycles VCS Complete and 3D quickSET. 3D quickSET measures and compensates the rotary and swivel axes, while VCS Complete calibrates the volumetric accuracy of the machine. This enables up to 30 percent higher accuracy over the entire service life of the machine. "VCS Complete notably compensates even the very low tolerances of a brand new machine direct from the factory to within a few microns", explains Torsten Heil.

Volumetric accuracy optimized in just a few minutes

Torsten Heil checks the volumetric accuracy of the two DMU monoBLOCK machines every

four to six weeks with the technology cycle: "We also use the technology cycle after a tool breakage or a collision." The QuickCheck only takes a few minutes. The measured values are proof of the real added value of the volumetric compensation: "The positional tolerances of opposing bores and the concentricity are far more accurate. This enables us to guarantee the accuracy of the high-precision parts." In 2018 CNC-Technik Heil was the first customer to use VCS Complete. "The experience gained in the field test was incorporated into the further development of the technology cycle", says Torsten Heil of the collaboration with DMG MORI.

Enthusiasm for challenging projects

Torsten Heil demonstrates his enthusiasm for the production of demanding components from time to time with especially challenging demonstration parts, such as the model of an Airbus A320 or the helmet of Darth Vader. The milling expert documented their creation on his own YouTube channel. "The NC program included over 40 million datablocks", recalls Torsten Heil, looking back of the many days of programming. "We will continue to concentrate on complex, high-precision pieces and on

producing them economically", claims Torsten Heil underscoring his business philosophy. Where production technology is concerned, he already has his eye on new machines. "We will optimize chip flow during machining even further with the DMU H monoBLOCK series." It goes without saying that VSC Complete will also be used to ensure a high level of volumetric accuracy for the upcoming installations.

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CNC-TECHNIK HEIL FACTS

- + Founded in Remscheid in 2018
- + Production of demanding, high-precision components
- + Small batch and prototype production for mechanical engineering, motor sport and aerospace

CNC-Technik Heil GmbH

CNC-Technik Heil GmbH
Raiffeisenstraße 10
42897 Remscheid, Germany
cnc-technik-heil.jimdofree.com



In 2018 CNC-Technik Heil installed a DMU 75 monoBLOCK and a DMU 95 monoBLOCK – both equipped with the DMG MORI Technology Cycle VCS Complete.

CNC-Technik Heil shows the creation of especially challenging demonstration components on its own YouTube channel.



μ-ACCURACY AND AUTOMATED COMPLETE MACHINING IS A FACTOR OF SUCCESS



The grinding cycle of the DMC 125 FD duoBLOCK enables internal, external and face grinding as well as dressing of the grinding wheel.



We have found a partner in DMG MORI that supports us in all areas – whether μ-precise milling, turning or grinding. Also in the fields of automation and service. Everything from a single source.

Lars Friedrich
HAVLAT Präzisionstechnik GmbH

HAVLAT Präzisionstechnik GmbH has developed over its 40 years in business from a one-man garage workshop to become a competent partner in precision machining. Its 250 experienced specialists make the family-run business in Zittau one of the biggest employers in the region. With around 80 machine tools in a production area of 14,000 m², HAVLAT guarantees trouble-free production of precision components and assemblies for machine tool construction and energy technology. For many years the company has trusted in productive and efficient CNC technology from DMG MORI, a fact further underscored by the three latest purchases: a DMC 125 FD duoBLOCK with grinding capability and 12-station rotary pallet storage system, a DMC 210 U **μPrecision** with pallet pool and a TAIYO KOKI – vertical grinding machine with pallet changer and loading station. In order to ensure maximum machine availability, HAVLAT has concluded a DMG MORI Full Service agreement for all three models. Service is further optimized by the online portal *my DMG MORI*.

μ-accurate precision components

Key industries like aerospace and medical use extremely accurate machine tools. This level of accuracy is based on core components such as the machine bed, slideways and table. "We specialize in the production of

13 μm
VOLUMETRIC
ACCURACY IS
COMPELLING

such demanding μ-accurate precision components", explains Lars Friedrich, Managing Director of HAVLAT. The process begins early on with consultation and planning: "We support in particular customers who have no production of their own with our expertise with regard to feasibility and process optimization." HAVLAT sees itself as a holistic partner, so it also offers assembly and ensures on-time delivery.

Complete machining with CNC technology from DMG MORI in 3-shift operation

An ultra modern shop floor that HAVLAT utilizes over three shifts is the backbone of production, where 25 models from DMG MORI, among others, are in operation. The machines range from universal models such as the DMU 50 through to large DMC Portal machining centers and CTX gamma TC turn-mill centers. "It has long been our goal to produce components in as few clampings as possible", says Production Manager Norbert Heinz of the production strategy. That is why 5-axis milling and 6-sided complete machining are integral parts of production. "Fewer reclamping operations mean shorter idle times and therefore higher productivity", sums up Lars Friedrich. The same is true for automation solutions with the aid of

robots and pallet changers. "We have found a partner in DMG MORI that supports us in all areas – whether μ -precise milling, turning or grinding and also in the field of automation and service."

TAIYO KOKI CVG 6: pallet changer with loading station and tool magazine for up to 6 grinding tools

HAVLAT offers its comprehensive service by using a wide range of machines from DMG MORI. Even grinding – which has been part of the company's offering for 20 years – is carried out in part on models from the machine tool manufacturer. The Vertical Mate 85 from TAIYO KOKI has been in operation since 2016.



Following the installation of a Vertical Mate 85, HAVLAT bought another machine for grinding from TAIYO KOKI: the CVG 6.

TAIYO KOKI HIGH-PRECISION VERTICAL GRINDING

VERTICAL MATE

with automatic tool changer (up to 6 tools) and 22.5° swivel head \varnothing from 150 to 1,250 mm

CVG

2 grinding spindles for internal, external and CAM grinding \varnothing from 300 to 1,300 mm

OVER 550
MACHINES
INSTALLED
WORLDWIDE

<p>0.7 μm circularity</p> <p>Spur gear \varnothing 430 x 235 mm SNCM420 Ra 0.17 μm 1.2 μm circularity</p>	<p>Ra 0.23 μm</p> <p>Chuck body \varnothing 600 x 140 mm SCM Ra 0.23 μm 1.3 μm circularity</p>	<p>2 μm circularity</p> <p>Marine engine cam 75 x 290 x 390 mm SCM415 Ra 0.4 μm 2 μm circularity</p>	<p>Ra 0.15 μm</p> <p>Spindle housing \varnothing 441 x 445 mm FC300 Ra 0.4 μm 0.7 μm circularity</p>
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DMC 125 FD duoBLOCK

MILLING, TURNING AND GRINDING

HIGHLIGHTS

- + Large workpieces up to $\varnothing 1,250 \times 1,600$ mm and 2,000 kg
- + Grooving, undercutting, stock removal
- + Grinding cycles for internal, external and face grinding and dressing cycles
- + Powered dressing unit for aluminum oxide and CBN grinding wheels
- + Surface quality Ra to $0.4 \mu\text{m}$
- + Circularity $5 \mu\text{m}$
- + Quality 4 with diameter > 300 mm

"The quality and repeatability of the TAIYO KOKI machine impressed us so much that we hit the jackpot again with our latest expansion of capacity", recalls Lars Friedrich. DMG MORI installed a CGV-6 at the beginning of 2019. The vertical grinding machine from TAIYO KOKI grinds inside diameters of between $\varnothing 50$ and $\varnothing 600$ mm and outside diameters up to $\varnothing 600$ mm. Another advantage compared to other grinding machines is the pallet changer for up to three pallets and the tool magazine: "It means we can use several grinding tools with a single spindle."

DMC 125 FD duoBLOCK – milling, turning and grinding to $0.4 \mu\text{m}$ Ra

Grinding also found its way into the milling area when HAVLAT put a DMC 125 FD duoBLOCK into operation, also in 2019. The machining center is equipped with grinding capability. "So we have the possibility to turn, mill and finally grind rotary tables or docking flanges, for example", explains Norbet Heinz. The grinding cycle enables internal, external

and face grinding as well as dressing of the grinding wheel. "We achieve surface qualities down to $0.4 \mu\text{m}$ Ra and circularity of $5 \mu\text{m}$." Thanks to this complete machining, the company can produce complex precision components competitively. The twelve-station rotary pallet storage unit also plays its part, adds Lars Friedrich: "It allows us to set up during machining and so utilize the full capacity of this machine with minimum idle time in three-shift operation."

DMC 210 U μ Precision – 13 μm volumetric accuracy

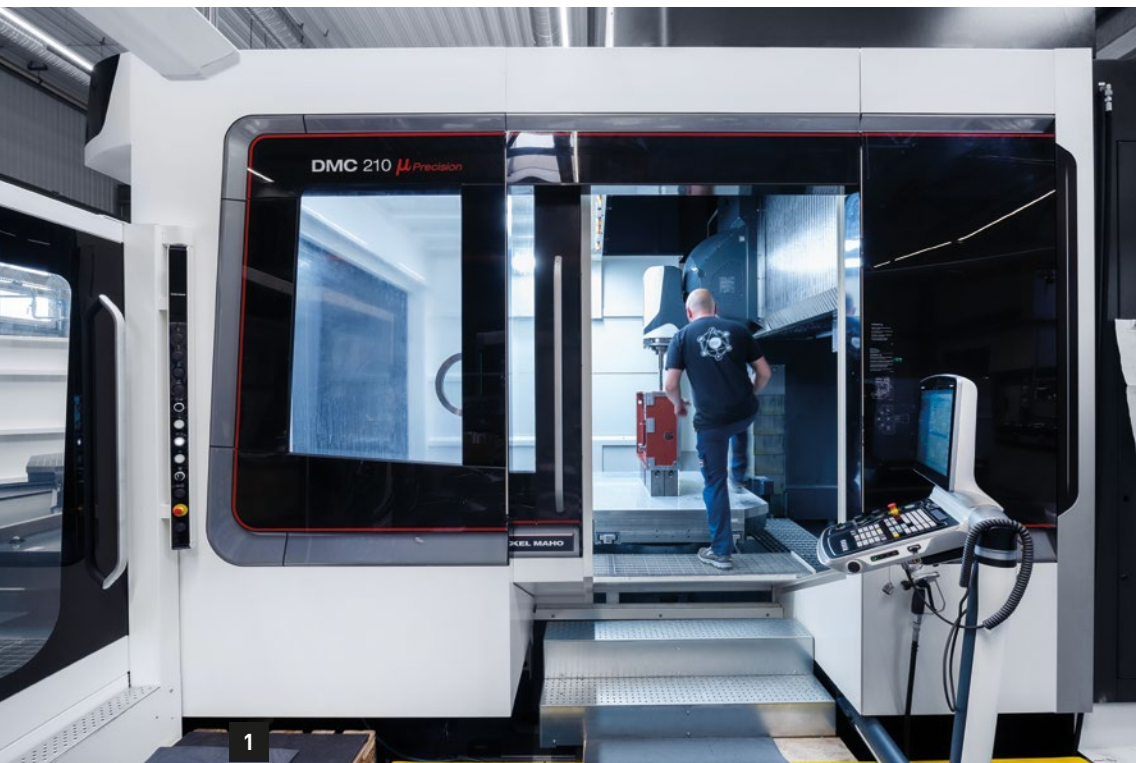
HAVLAT recently installed its third machining center: a DMU 210 U μ Precision that is designed specifically for precision. Its volumetric accuracy is $13 \mu\text{m}$ and its positioning accuracy is $4 \mu\text{m}$ in all axes. "The purchase resulted from the demanding requirements of customers", explains Lars Friedrich the investment. "As our components are essential for the precision of machine tools, we want to get the maximum quality from our



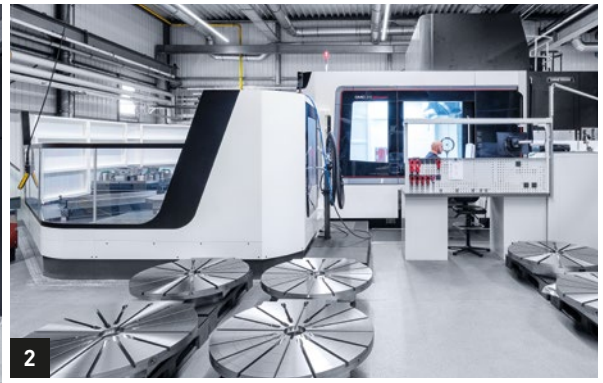
Equipped with grinding capability, the DMC 125 FD duoBLOCK achieves surface qualities down to $0.4 \mu\text{m}$ Ra and circularity of $5 \mu\text{m}$.



HAVLAT has concluded a DMG MORI Full Service agreement for all of the machines: the TAIYO KOKI CGV-6, the DMU 125 FD duoBLOCK and the DMU 210 μ Precision, in order to guarantee reliable production with minimum downtime.



1+2. The volumetric accuracy of the DMU 210 U *μPrecision* is 13 μm and positioning accuracy is 4 μm in all axes. **3.** A five-station pallet pool boosts the productivity of the DMU 210 U *μPrecision*.



machines.” The pallet pool with five stations was, of course, decisive for the purchase of this machine as well.

DMG MORI Full Service: All-round carefree package for new machines

With the purchase of the two 5-axis machining centers, HAVLAT also made use of DMG MORI Full Service. This is valid for the first three years after the purchase of

DMG MORI’s Full Service prevents unscheduled and lengthy machine downtime.” Its scope includes the manufacturer’s annual service with replacement of all wear parts plus machine breakage insurance.

myDMG MORI:

Absolute transparency in service

The fact that innovation also optimizes service is illustrated by the introduction of myDMG MORI. The online portal enables customers to send damage reports simply at the touch of a button. “Screen shots and videos can also be attached, so the service technicians can get a better picture of a respective case”, says Norbert Heinz describing the procedure. In this way the message reaches the right service technician quickly. “We get an online confirmation and can track the status of the service process transparently at all times.” The detailed description also prevents unnecessary travel, because the DMG MORI Service can order the necessary spare parts in advance before the technician sets off.

Investment in machine tools and in personnel ensure the future of HAVLAT. “We satisfy our need for new skilled staff with 30 trainees”, says Lars Friedrich with reference to the promotion of new talent. The company has already scored top marks as a training

company in a Germany-wide evaluation. This commitment also pays off for the company as a whole. Just last year HAVLAT was awarded an entrepreneur prize. Lars Friedrich is convinced: “We have created an excellent basis for future generations to continue our successful corporate mission.”

«

HIGH-PRECISION – MILLING, TURNING, GRINDING IN A SINGLE SETUP.

a new machine. A fixed monthly fee covers all service and spare parts, so there are no unexpected repair costs. It goes without saying that the DMG MORI service technicians only ever use original spare parts. All travel and incidental expenses are included in the fixed price. For Sandor Pinter, Production Manager Technology, this security is worth its weight in gold in day-to-day business: “If we wish to remain competitive, we must utilize production to the full around the clock.

HAVLAT PRÄZISIONSTECHNIK FACTS

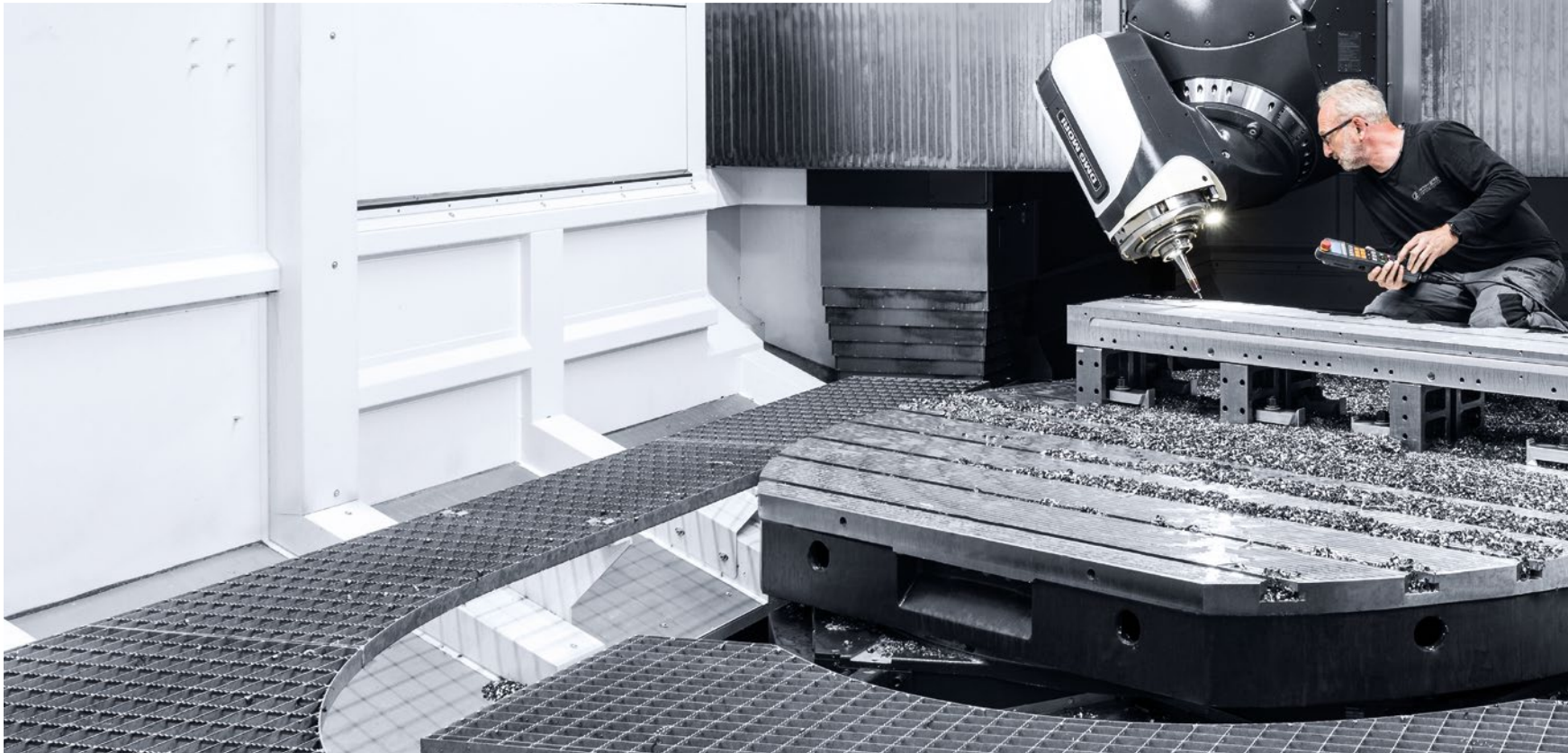
- + Founded in Großschönau in 1980
- + Family-run business with 250 skilled staff
- + Precision machining of components and assemblies for the machine tool construction and energy sectors

havlat
PRÄZISIONSTECHNIK SEIT 1980

HAVLAT Präzisionstechnik GmbH
Gerhart-Hauptmann-Straße 17
02763 Zittau, Germany
www.havlat.de



OVER 20 YEARS OF SUCCESSFUL GROWTH WITH DMG MORI



The family company Riemann GmbH from Georgsmarienhütte has established itself as a reliable tool making and machining partner since 1988. Large OEMs, including those from the automotive industry, agricultural sector and mechanical engineering in general, rely on the expertise of a team of almost 50 experienced specialists. The sustained growth of the company led to a doubling of its production area in 2017 and further expansion of its capacity. Machining comprises XXL machines such as the DMU 340 P and DMU 600 P plus a DMU 90 P duo-BLOCK for smaller workpieces.

A DMU 340 Gantry **linear**, the eighth DMG MORI model in total, will be put into operation in the fourth quarter of 2020.

Full customer care as the basis for success

As a manufacturer of tools for sheet metal working, Riemann is keenly aware of the quality parameters that the complex tools depend upon. "Together with our customers, we develop the tool concept that is right for them and know how to maximize the tool's service life and precision. In this respect, precision and surface quality are key – one reason why we have relied on DMG MORI for over 20 years," says Michael Riemann. Together with his brother Peter Riemann, he

runs the company their father founded. The automotive industry in particular represents a large share of their sales: "On one hand, this places stringent demands on quality and precision and, on the other, the competitive pressure is enormous."

Riemann follows an overarching strategy to meet these high demands. "Already during the planning phase, we consider all the options available to design the entire process to be efficient and customer orientated," explains Michael Riemann. The design and manufacturing process is all about continuously optimizing all workflows. "Before a tool leaves our plant, we test it in our 2,500-ton press." Assembly and service complete the



The work area of the DMU 340 P measures 3,400 × 3,400 × 1,600 mm. Maximum table load is 16 t.



Precision and surface quality are key – one reason we have relied on DMG MORI for over 20 years.

Peter Riemann (left) and Michael Riemann (right)
Managing directors of Riemann GmbH
Klaus Riemann (middle)
father and founder of the company

offer. "This comprehensive approach is sure to be an especially important success factor," adds Riemann.

STRONG PARTNERSHIP THAT PAYS OFF

Michael Riemann lists the reasons his company has been working with machine tools from DMG MORI since 1999 as the reliability of the machines, their high precision and extended long-term accuracy: "We

machine our tool components to within tens of microns." The lead-time is often as much as 70 to 80 hours per component. "We utilize the entire range of machining technology – from 3-axis to simultaneous 5-axis milling of freeform surfaces. Ultimately, we will continue to grow successfully with DMG MORI machines."

From small to large – everything from a single source

The production of demanding tool components is carried out on the machine tool manufacturer's machining centers. "Whether we are producing small or large components, thanks to DMG MORI all machines come from the same manufacturer, which means we don't

need to get used to different control systems or other aspects of the machine." For example, knives and thermoformed tools are produced on the DMU 90 P duoBLOCK and large components on the DMU 600 P with its 6,000 mm travel. "It was the second DMU 600 P installed after its launch in 2012 by DMG MORI." The first one is at Volkswagen in Braunschweig.

»



1+2. The second DMG MORI DMU 600 P was installed at Riemann in 2012.
3. As an experienced partner in tool making, Riemann supports its customers in the tool planning and design phase.



DMU 340 GANTRY *linear*

HSC MACHINING IN XXL FORMAT

HIGHLIGHTS

- + Linear drives in the X-axis and Y-axis **with up to 90 m/min rapid traverse**
- + **X-axis** with 3,400 mm, 6,000 mm optional
- + **B-axis with direct drive** and 50° swivel for negative angles up to -10°
- + One-piece machine bed for **components up to 30 t**

DMU 340 P: Large cubic components up to 16 t

The entire range of possibilities of the DMU 340 P, which was installed in spring 2020, was utilized. "From heavy-duty machining with more than 400 Nm torque to high-precision finishing," sums up Peter Riemann. DMG MORI ensures the required long-term accuracy with cooled linear guideways and active compensation for potential spindle misalignment. The space-saving wheel magazine offers space for 123 tools. "This allows us to significantly reduce our setup times." The work area of the DMU 340 P measures 3,400×3,400×1,600 mm and table load is up to 16 t. "This makes the machine the perfect size between the DMU 600 P and the smaller DMU 200 P, exactly right for many cubic tool components," says Michael Riemann.

DMU 340 Gantry *linear*: HSC machining in XXL format

Right next to the DMU 340 P, the foundations have already been completed for another large machine from DMG MORI, which will be put into service in the fourth quarter of 2020: the DMU 340 Gantry *linear* with travels of 3,400×2,800×1,250 mm. The XXL model offers maximum rigidity due to its one-piece thermo-symmetrical machine bed and the overhead gantry design with uniform moving masses. "In combination with the linear drives in the X- and Y-axes, we achieve high surface quality when HSC machining," explains Michael Riemann. Another reason for this acquisition was the high table load of up to 30 t.

myDMG MORI: TRANSPARENT SERVICE WITH TRACK & TRACE

The long-term cooperation with DMG MORI has also grown in respect of service. This is a decisive factor for Michael Riemann: "In the event of machine downtime, we rely on rapid assistance and delivery of spare parts to remain competitive." This is why he welcomes the latest developments in this area. The machine tool manufacturer has developed an online service platform called *myDMG MORI*, which allows users to report any problems directly – including error messages, screen-shots and videos. This means the service

enquiry is immediately forwarded to the right expert who then finds a fast solution. Michael Riemann adds: "The Track & Trace function displays the status of the service process transparently at all times."

Experienced specialists – Riemann trains its own junior staff – and reliable and innovative machinery are important for Michael Riemann looking towards the future: "We would like to continue to grow actively while retaining our regular customers and acquiring customers in new production areas and industries."

RIEMANN FACTS

- + Founded in Georgsmarienhütte in 1988
- + Almost 50 specialists
- + Tool supplier for sheet metal processing
- + Customers from the automotive, agricultural and mechanical engineering industries



riemann gmbh
werkzeugbau

Riemann GmbH
Werner-von-Siemens-Str. 37
49124 Georgsmarienhütte
Germany
www.riemann-werkzeugbau.de



You can find the video on the customer story here:
<https://dmgmori.com/riemann>

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PRECISION COMPONENTS MACHINED TO $\pm 5\mu\text{m}$ FOR THE SEMICONDUCTOR INDUSTRY



NTX 2000

6-SIDED TURN & MILL COMPLETE MACHINING

HIGHLIGHTS

- + 5-axis simultaneous machining of complex workpieces with direct drive (DDM technology) in the B-axis
- + compactMASTER – the world's shortest spindle in its class (350 mm), ensures a wide machining envelope to increase productivity
- + Large machining area with an X-axis stroke of 675 mm (-125 – +550 mm) and a 300 mm (± 150 mm) Y-axis
- + CELOS with MAPPS on FANUC or CELOS with SIEMENS

Based in Saitama, Japan, KT Tech manufactures components for robotics, the medical sector and the food industry. By entering the semiconductor industry, the young company has expanded its production capacity. Production is designed for small batch sizes and a variety of different workpieces. Above all, there is a high demand for precision. Orders from the semiconductor industry in particular are setting new standards. In order to meet such requirements, KT Tech has relied on CNC technology from DMG MORI for many years. The 27 models include turning centres in the NL and NLX series as well as ten turning / milling centres in the NT and NTX series. One of the more recent installations is an NTX 2000.

Thanks to Turn & Mill technology from DMG MORI, new business sectors have opened up

As a supplier to key industries such as the semiconductor and medical sectors, KT Tech is faced with the challenge of manufacturing high-precision components economically on

a daily basis. "This is why we depend on advanced and flexible CNC technology," explains Toshinobu Kamiyama, President KT Tech. 6-sided Turn & Mill complete machining is the solution to significantly shortening delivery times, reducing set-up effort and increasing capacity. "Component accuracy also improves when we clamp less frequently. This enabled us to open up new markets such as the semiconductor industry".

compactMASTER: MILLING POWER OF A MACHINING CENTER

NTX 2000: 6-sided Turn & Mill complete machining including deburring

With the recently installed NTX 2000, KT Tech has a total of ten of the productive machine

*Turn & Mill raised
our product portfolio
by 40 percent.*

Toshinobu Kamiyama
President
KT Tech Co., Ltd.



tools. "Thanks to integrated turn-mill machining, we can perform all operations on the NTX 2000 that would normally require different turning centers and milling machines," says Toshinobu Kamiyama. Manual deburring is also eliminated thanks to 5-axis machining. The heart of the machine is the compactMASTER turning/milling spindle, which with over 120 Nm provides the same milling performance as a normal machining centre. It also comes with a 36 month unlimited hours warranty. Since the introduction of turning/milling centres, KT Tech increased its production capacity by 40 percent to around 1,400 workpieces per month. The range of components that can be produced on the NTX 2000 extends up to a diameter of $\varnothing 660$ mm and a maximum length of 1,540 mm.

$\pm 5 \mu\text{m}$ thanks to turning and 5-axis milling in a single set-up

For KT Tech, one of the most important points when using the NTX 2000 is the high precision of the turning/milling centre. "The combination of turning and 5-axis simultaneous

machining in one clamping allows us to produce complex geometries within a tolerance of $\pm 5 \mu\text{m}$," says Toshinobu Kamiyama, pleased with the impressive results. There were learning curves in the area of programming: "The complexity in turning/milling requires a rethink, which our young employees were able to master quickly and successfully after a four-week training course."

With NTX machines into the future

KT Tech will stick to its strategy of further optimizing processes: "We will continue to invest in advanced technologies such as 6-sided complete machining on the NTX models in the future," Toshinobu Kamiyama looks ahead. "With the NTX machines, we will be able to flexibly and productively handle the increasingly varied production."

KT TECH CO., LTD. FACTS

- + Headquartered in Saitama, Japan
- + Manufacture of components for robotics, the medical sector and the food industry
- + Increase in capacity with its entry into the semiconductor industry

 株式会社 ケー テー テック

KT Tech Co., Ltd.
Shinwa 1-433-1, Misato-City,
Saitama 341-0034, Japan
www.kt-tec.co.jp



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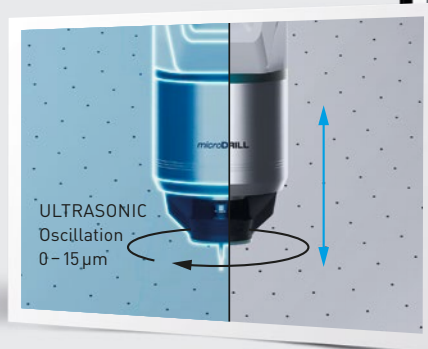
ULTRASONIC microDRILL

THE SEMICONDUCTOR INDUSTRY IS PUTTING ITS MONEY ON ULTRASONIC – UP TO 30,000 MICRO DRILLED HOLES IN QUARTZ GLASS

- + **ULTRASONIC:** Established technology for the production of complex components made of glass and ceramics
- + **Semiconductor industry:** Growth market with increasing demands on performance
- + **Your advantage:** Considerably higher productivity, lower component damage (SSD) and high process reliability
- + **Flexible integration** into ULTRASONIC machines via HSK-A63 interface

ULTRASONIC microDRILL UP TO 50 % FASTER THAN A CO₂ LASER

- + Motor spindle up to 32,000 rpm for drilling from $\varnothing 0.1$ mm
- + Automatic ejector mechanism for cores from the hollow diamond drills
- + Excellent process reliability thanks to fully integrated regulation of the drilling force < 1 N
- + ICS with separate fine filtration and flow rate control starting from 1 l/min



Luke Ivaska
Product Specialist
Advanced Tech Center of
Excellence DMG MORI USA, Inc.



Silicon carbide
wafer chuck



Silicon wafers



Since October 1, 2020:
SAUER GmbH became ...

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ULTRASONIC | LASERTEC

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Tel.: +49 6544 99199 0

LASERTEC site:
DMG MORI
Ultrasonic Lasertec GmbH
DECKEL MAHO-Str. 1
87459 Pfronten
Tel.: +49 8363 89 0



3D (hybrid) **BECOMES DED (hybrid)**

SAUER GmbH, well known for machines in the ULTRASONIC and LASERTEC series since 2001, will now be managed under the company name DMG MORI Ultrasonic Lasertec GmbH. The machine names of the LASERTEC **3D** and **3D hybrid** series are therefore changed to LASERTEC **DED** and **DED hybrid**.

DMG MORI is clearly differentiating between the different additive manufacturing technologies by integrating the powder nozzle technology (**DED** – Direct Energy Deposition) into the product name.

ADDITIVE MANUFACTURING

BATCH SIZE OF 1 IN SERIES PRODUCTION

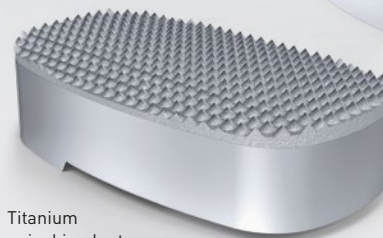


Nils Niemeyer
Manager - Sales and Service
DMG MORI Advanced Solutions, Inc.

- + **Outstanding prerequisites:** Additive manufacturing by the powder bed process with the LASERTEC *SLM* series
- + **Growth in medical technology:** Tailor-made knee and hip implants, bone plates or dental prostheses
- + **Certification challenge:** Digitize manufacturing processes and enable paperless documentation of material batches, for example, with TULIP
- + **Powerful partner:** Qualified powder materials from certified suppliers from the DMQP program
- + **Holistic understanding of processes:** Everything from a single source from additive manufacturing to CNC machining
- + **Full support:** Consultation, design and ramp-up of production with experts from ADDITIVE INTELLIGENCE



Titanium
knee implant



Titanium
spinal implant



POWDER
CHANGE
<2h

Since October 1, 2020:
REALIZER GmbH became ...

DMG MORI
ADDITIVE

DMG MORI Additive GmbH
Gildemeisterstraße 60
33689 Bielefeld
Tel.: +49 5205 74 2357

LASERTEC 30 DUAL *SLM*: 80 % MORE PRODUCTIVITY (2 × 600 W DUAL LASER)

- + Generative manufacturing in a powder bed with build volumes up to 300 × 300 × 300 mm
- + Unique accuracy: 50 µm focal spot and comprehensively cooled optics module
- + Permanent filtration system independent of material with > 3,000 h filter service life and innovative recycling concept



Additive manufacturing and high-precision milling: With six LASERTEC 12 *SLM*, two DMP 70 and one MILLTAP 700, LABVISION has established a hybrid process chain in dental technology.



DMP 70 for finish machining.

HYBRID PROCESS CHAIN FOR HIGH-PRECISION DENTAL PROSTHESES



LABVISION produces implants, prostheses and frameworks for dentists and dental laboratories.

LABVISION, from Bucharest, Romania, was launched in 2014 to consolidate the distribution of intra-oral and lab scanners and modeling software with the manufacture of high-quality dental prostheses and implants. The 15-strong team combines extensive expertise and many years of experience in clinical dentistry technology with professional skills in modern CAD/CAM manufacturing processes. LABVISION puts

its trust in DMG MORI for innovative solutions. The process includes additive manufacturing using the powder bed method in six LASERTEC 12 *SLMs* and three compact machining centers – one MILLTAP 700 and two new DMP 70s.

“CAD/CAM manufacturing solutions have become increasingly important in dental technology over the past few years,” explains Dr. Radu Ignatescu, Managing Director of LABVISION. This applies to small systems as well as larger-scale ones. “Industrial manufacturing of dental prostheses and individual components for implants is growing faster than ever before.” LABVISION has positioned itself as a full-service supplier. LABVISION covers the entire range of services from scanners and the associated CAD design software through to the manufacture of advanced, high-accuracy frameworks.

As a full-service supplier, LABVISION has all modern technologies at its disposal including compact machining centers from DMG MORI.

The machine fleet has recently been expanded by six LASERTEC 12 *SLMs* for powder-bed additive manufacturing of metal workpieces. “This allows us to offer an integrated process that enables high-precision machining of complex geometries in cobalt chrome or titanium,” says Dr. Radu Ignatescu, explaining the investment.

LASERTEC 12 *SLM*: Closed powder circuit and focal spot diameter of 35 µm

One reason for LABVISION installing the LASERTEC 12 *SLMs* is their past experience with DMG MORI. “We have been using the MILLTAP 700 since 2018 and are very satisfied with the quality and service from DMG MORI,” says Dr. Radu Ignatescu. They were also impressed with the performance and build of the LASERTEC 12 *SLM*: “The closed powder circuit is a big advantage, as it provides us with excellent and consistent control of the respective powders.” Moreover, the precision of the powder bed machine in combination with the large build volume were also decisive factors. “A focal spot diameter of 35 µm



With a focal spot diameter of 35µm and a build volume of 125×125×200mm, the LASERTEC 12 SLM is unique in this class of machine.

Dr. Radu Ignatescu
Managing Director LABVISION.

and a build volume of 125×125×200mm are unique in this class of machine." Overall it is possible to achieve a workpiece density of 99.8 percent in cobalt chrome. "This corresponds to almost the reference value in conventional processes." The saving in materials is also an advantage compared to machining.

DMP 70: Dynamic precision machining of advanced materials

The recent installation of two DMP 70s means that LABVISION has now completed its additive manufacturing process. According

to Dr. Radu Ignatescu: "This is a hybrid process. We build up the complex dental products in the powder bed as a first step, followed by precise post-processing on the DMP 70." A comprehensive cooling system and high-precision machine components guarantee precision. For LABVISION, the high dynamics with rapid traverses of 60m/min, 2g acceleration and chip-to-chip times of 1.5 seconds also make the DMP 70 unbeatable when it comes to machining of dental products, states Dr. Radu Ignatescu: "We use it to produce cobalt chrome, titanium and also zirconia workpieces from the commonly used discs."

Single-part production to within microns

With the help of DMG MORI technologies, LABVISION manufactures the entire range of dental implants, prosthetics and dental fittings. "Each part is unique, as it is specifically produced for a patient," Dr. Radu Ignatescu emphasizes. The complexity of these products is just as challenging as the accuracy requirements. "The tolerances are up to 4µm, with a surface finish of Ra 0.1."

Dr. Radu Ignatescu believes the increasingly digitized processes in dental technology offer great potential for disruptive innovations. 65 percent of dentists are planning to purchase an intraoral scanner within the next two years. "This will continue to accelerate processes and means we will also be challenged in production to continuously optimize our processes – as is currently the case with the LASERTEC 12 SLM."

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LABVISION FACTS

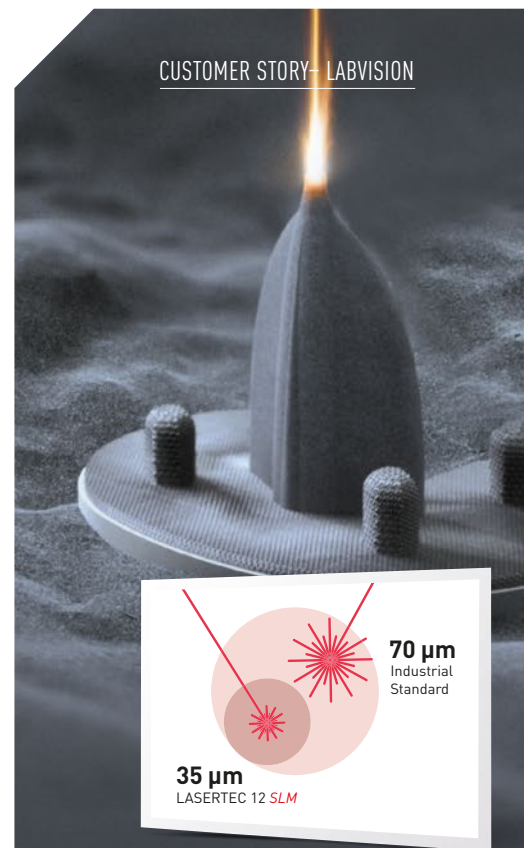
- + Founded in Bucharest in 2014
- + 15-strong team with many years of experience in dental technology
- + Manufacturing of high-quality dental prostheses for dentists and dental laboratories



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LASERTEC 12 SLM

35 µm FOCAL SPOT DIAMETER

- + **Additive manufacturing** in a powder bed with build volumes up to 125×125×200 mm
- + **35 µm focal spot diameter** for high precision
- + **rePLUG:** The powder module for maximum operational security and fast material change of <2 hours
- + **CELOS:** Integrated software solution from CAM programming through to machine control
- + **100 % open system:** Customized adaptation of all machine settings and process parameters

25-FOLD SHORTER LEAD TIMES THANKS TO *DED HYBRID* TECHNOLOGY



The ability to add material and mill workpieces alternately means that impellers can be manufactured with channels that run up to 360 degrees around the wheel.

It's all upwards from here – Sulzer's individual pump solutions in the oil and gas, energy and water treatment sectors can reach several thousand meters of head. Founded in 1834 in Winterthur, Switzerland, the company has been developing pumps for industrial applications since 1860. Sulzer also concentrates on the manufacture of complex rotating components as well as on separation, mixing and application technologies. With 180 production and service locations worldwide and 16,500 employees, the company works closely with its customers and takes innovative approaches to manufacturing, as demonstrated by the acquisition of a LASERTEC 65 *3D hybrid* (NEW: *DED hybrid*) from DMG MORI. Sulzer has been setting new standards in the manufacture of impellers using laser metal deposition since 2018.

Blade wheels are among the most heavily stressed components in pumps designed by Sulzer. Particulates in the liquids and acids can cause enormous wear. Nevertheless, the components are designed for a service life of 20 years. "The systems work much longer, however," explains Robin Rettberg, who is responsible for manufacturing technologies at Sulzer. "If an impeller like this has to be replaced, our customers need a spare part quickly." As these are mostly custom-made products, the company is unable to simply rely on its stocks.

Conventional process – 25 weeks lead-time

The challenge with impellers lies in their complex geometry. The conventional manufacturing process includes the design and production of a mold, casting of the raw part

and then final machining of the impeller, but it is not possible to reach all areas of the raw part using traditional methods. "The impellers have channels that sometimes run up to 360 degrees around the wheel," says Robin Rettberg. The complex process could take a total of at least 25 weeks.

1 WEEK LEAD – TIME INSTEAD OF 25 WEEKS

New way of process optimization and increased efficiency through hybrid manufacturing

When additive manufacturing had developed into a serious production alternative, Sulzer began to look at the different processes. While the first powder bed solutions involved difficulties in post-processing and were limited to layers to build up material, in 2018 DMG MORI came up with a solution in the form of a hybrid complete machining concept on a LASERTEC 65 *3D hybrid*. Based on a 5-axis machining center, the LASERTEC 65 *3D hybrid* combines additive manufacturing using a powder nozzle with sophisticated and highly precise milling to within microns in one clamping. "This allows us to alternately build almost any geometry in 5 axes and to finish mill important component areas before they are no longer accessible," says Robin Rettberg, describing the process. "This includes areas that were previously unable to be machined in the casting." Improved surfaces allow



Sulzer uses SIEMENS NX for CAD and CAM programming. Even at this early stage, there is a need for new ways of thinking about additive manufacturing to achieve optimal results.



The original manufacturing process for complex impellers took as long as 25 weeks due to the production of the casting mold. Additive manufacturing on the LASERTEC 65 *3D hybrid* reduces this to less than a week.

The **DED hybrid** technology from DMG MORI has enabled us to shorten our manufacturing process from 25 weeks to less than one week.

Robin Rettberg
Responsible for manufacturing technologies at Sulzer



From left to right: Kim Strasser, CAM programmer; Voislav Bozic, machine operator; Robin Rettberg, manufacturing technology engineer

Sulzer to achieve higher efficiency. There is also a further advantage over the earlier powder bed solutions: "Component diameter is not restricted by a build chamber of limited size." The LASERTEC 65 **3D hybrid** offers travels of 735 × 650 × 560 mm.

SIEMENS NX – hybrid CAD/CAM for product development, design and manufacture

Robin Rettberg was quickly confronted with a typical challenge of additive manufacturing after introducing the new process: "New ways of thinking are necessary as early as the design stage to ensure the potential of hybrid manufacturing can be fully exploited." Sulzer therefore uses SIEMENS NX for CAD and CAM programming. The software has been developed in cooperation with design engineers from DMG MORI and SIEMENS and is the most powerful solution in the area of powder nozzle technology from programming to production.

Advanced additive process – one week lead-time

Manufacturing impellers continues to be a complicated process. The design and programming alone take up approximately half a week. Ultimately, the new hybrid process is many times faster. "We are able to reduce the entire lead-time from 25 weeks down to less than one," Robin Rettberg is pleased at the milestone. The fast material build rate of the LASERTEC 65 **3D hybrid** also contributes to this. Depending on the material, it is 1 kg per hour.

Now that Robin Rettberg and his team have established a reliable process for manufacturing impellers on the LASERTEC 65

3D hybrid, Sulzer is sure that this is a pioneering solution. "We would like to continue to increase capacity in this area as the technology allows us to react even more flexibly to customer requirements."

Should our current machine no longer be able to meet demand, we have already had a look at the LASERTEC 125 **3D hybrid** from DMG MORI. It offers the same technology and hardware with which we are already very familiar and well trained. Due to its size, it also opens up the option of processing components up to Ø1,250 mm and 745 mm in the Z-axis, and up to a max. weight of 2,000 kg.

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SULZER FACTS

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- + 16,500 employees worldwide
- + 180 production and service locations
- + Sales of 3.7 billion CHF

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