

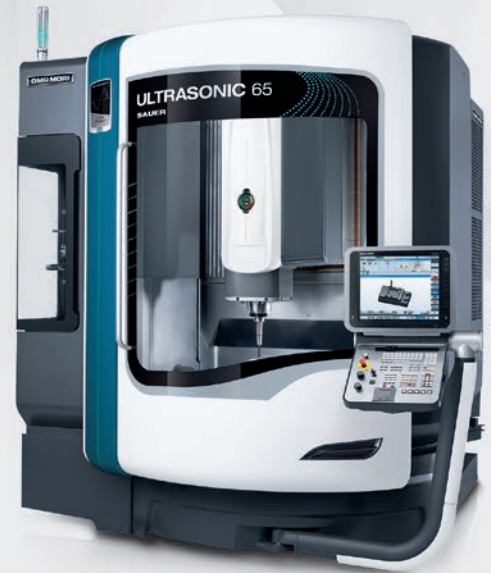
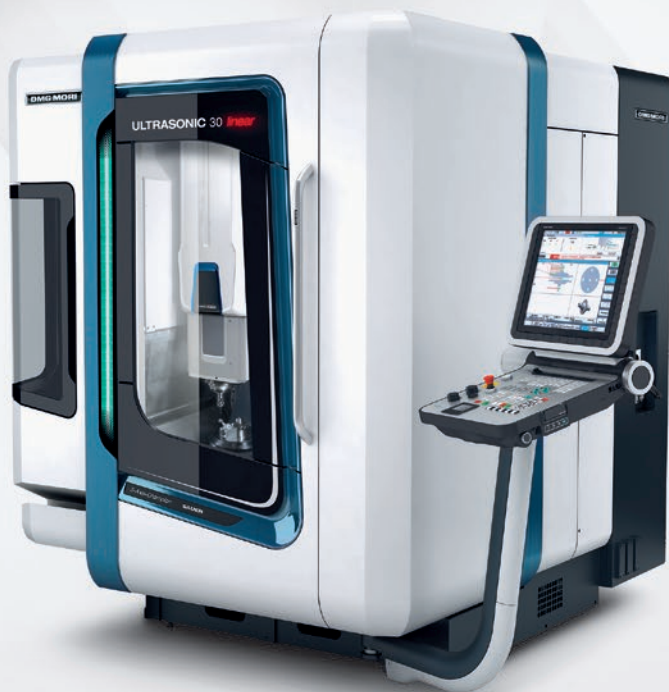
ULTRASONIC 10

ULTRASONIC 30 *linear*

ULTRASONIC Integration  
in DMG MORI Machines

Technology leader in the machining of advanced materials

# ULTRASONIC Series



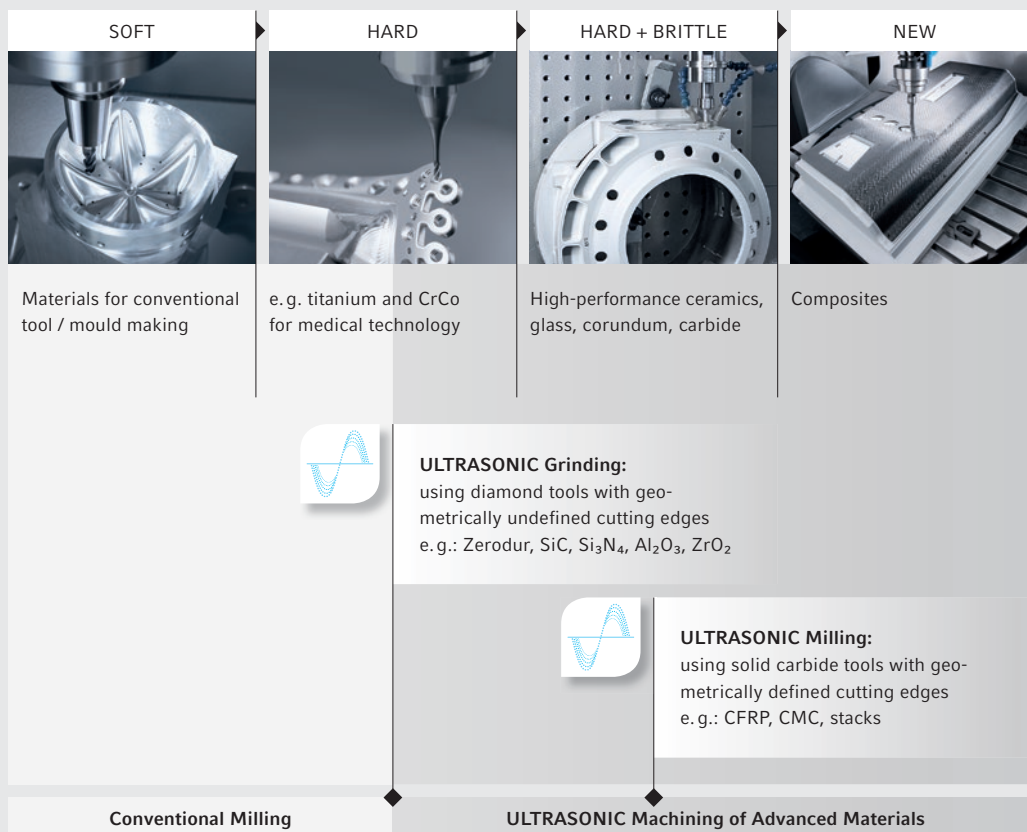
## ULTRASONIC Series

# With Ultrasonic into the Future.

ULTRASONIC represents a pioneering technology for the production of complex geometries in high-tech materials. It has applications in almost every industry and is growing in demand. Due to the kinematic overlapping of the tool rotation with an additional oscillation, high-performance materials, which are normally difficult to machine, can be economically processed with the highest quality. The low process forces allow the production of slim bases and result in longer tool service life and significantly reduced micro-cracks in the material. Depending on the material properties, outstanding surface finishes of  $Ra < 0.1 \mu m$  can also be achieved.

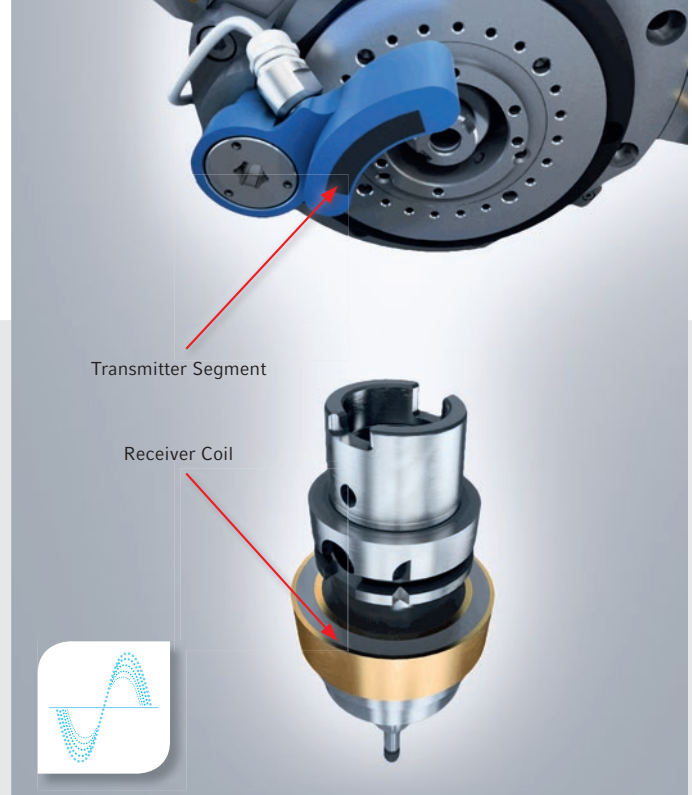
Thanks to the flexible integration of the ULTRASONIC HSK actuator system, ULTRASONIC and (HSC) milling can be combined on one machine. This allows operators to machine an unrivalled wide range of materials.

## All-in-one: ULTRASONIC and 5-axis Milling





ULTRASONIC  
Oscillation  
20–50 kHz



When changing to the HSK tool holder, an inductive transmission of the ULTRASONIC frequency from the fixed transmitter segment at the spindle tip takes place to the rotating coil on the HSK holder.

## ULTRASONIC Target Market



### Optical Industry

- + Zerodur
- + Optical glass
- + Quartz glass



### Watch Industry / Precision Engineering

- + Zirconium oxide
- + Sapphire, ruby



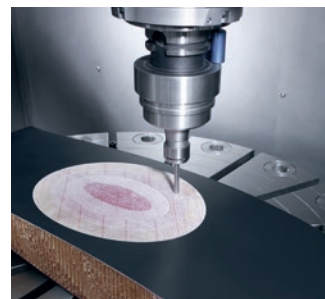
### High-Performance Ceramics

- + Oxide ceramics
- + SiC, Si<sub>3</sub>N<sub>4</sub>



### Medical Technology

- + Pressed zirconium oxide
- + Foamed materials



### Composites

- + CFRP, GFRP, AFRP
- + CMC
- + Stacks



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ULTRASONIC Series

## Flexible ULTRASONIC integration in 5-axis milling centres from DMG MORI.

The demand for new technology solutions and economical machining procedures for challenging advanced materials is growing in all high-tech industries. This is where SAUER is well positioned to further ULTRASONIC technology through their technical expertise in ultrasound-supported hard machining of advanced materials with a universal range of products and intelligent software tools. Based on a HSK-32 / -40 / -63 / -100 tool holder, the patented ULTRASONIC actuator system can be integrated flexibly into almost all 5-axis milling centres from DMG MORI.

04

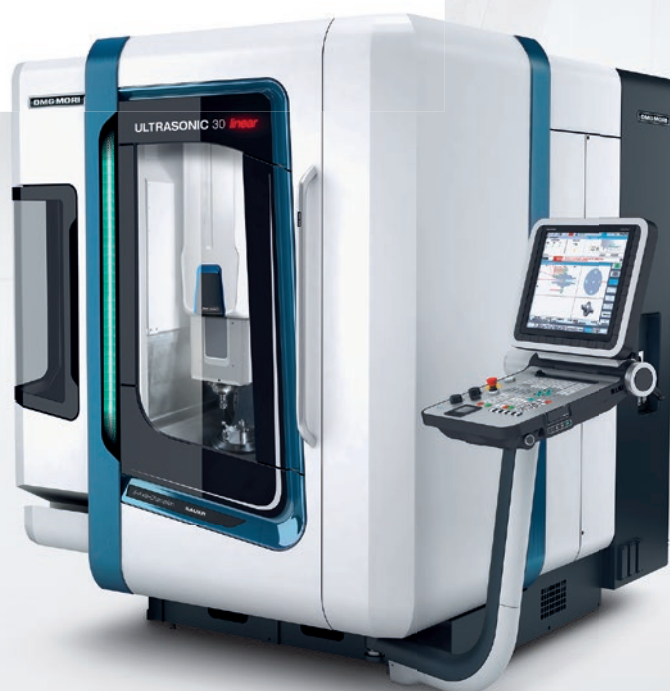
### The most compact 5-axis machine from DMG MORI

+ ULTRASONIC 10



### High-precision machine with comprehensive temperature management

+ ULTRASONIC 30 linear





- 1 Inductive Interface
- 2 ER Interface
- 3 Diamond Tool
- 4 ULTRASONIC Oscillation

### Operating Principle

The standard tool rotation is superimposed via the HSK-32 / -40 / -63 / -100 interface of the ULTRASONIC actuator tool holder with an additional oscillation in the axial direction (piezoelectric effect).

## ULTRASONIC operating principle / benefits



### Best Roughness Values

$Ra < 0.1 \mu m$  (depending on material characteristics)



### Self-sharpening Effect

Micro-chipping of the diamond grains on the tool cutting edge



### Process Forces

Reduced process forces and temperatures



### Tool Service Life

Up to 2x longer tool service life



### Particle Rinsing

Improved particle rinsing in the active zone

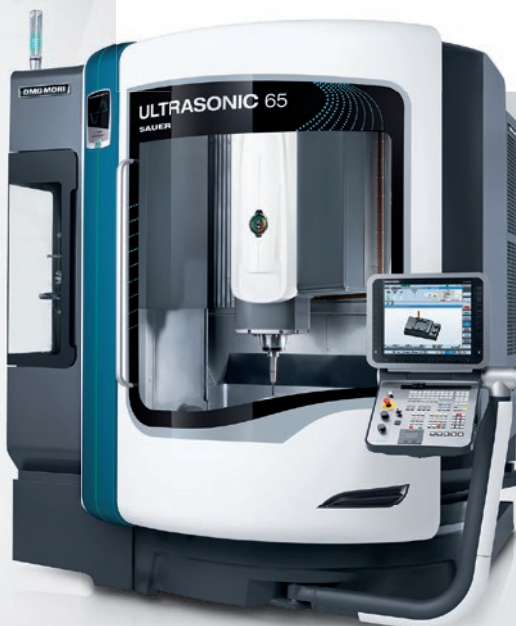


### Removal Rates

Higher removal rates compared to conventional machining

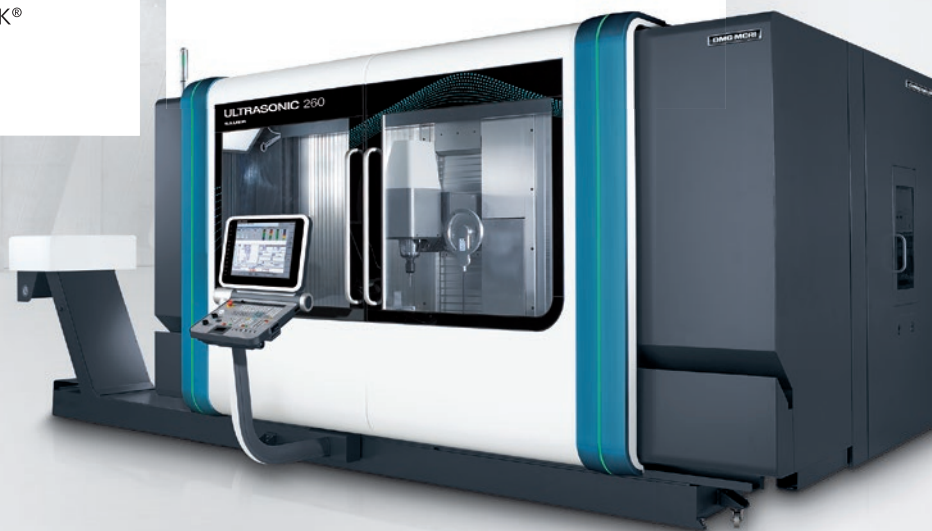
### Flexible Integration in DMG MORI Machines

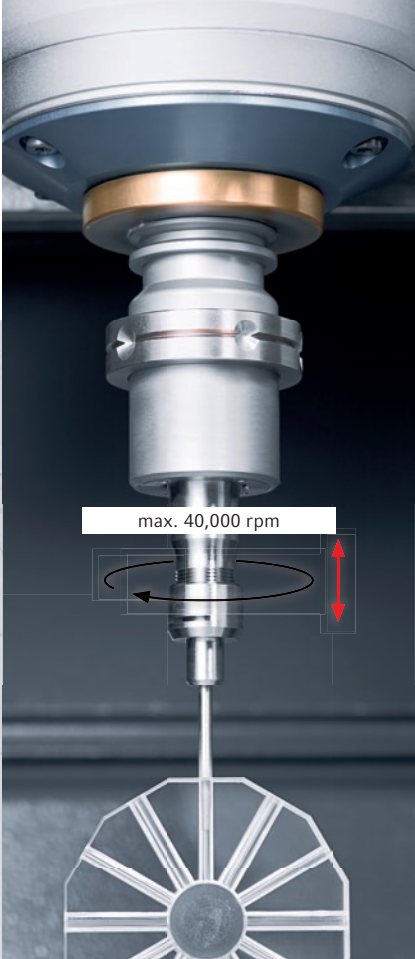
- + Universal
- + eVo linear
- + monoBLOCK®
- + duoBLOCK®



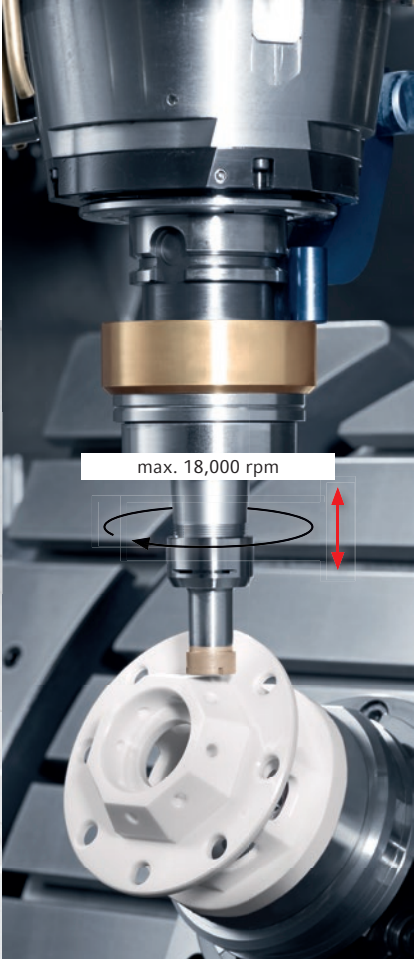
### COMPOSITES

- + ULTRASONIC 85
- + ULTRASONIC 260
- + ULTRASONIC 360

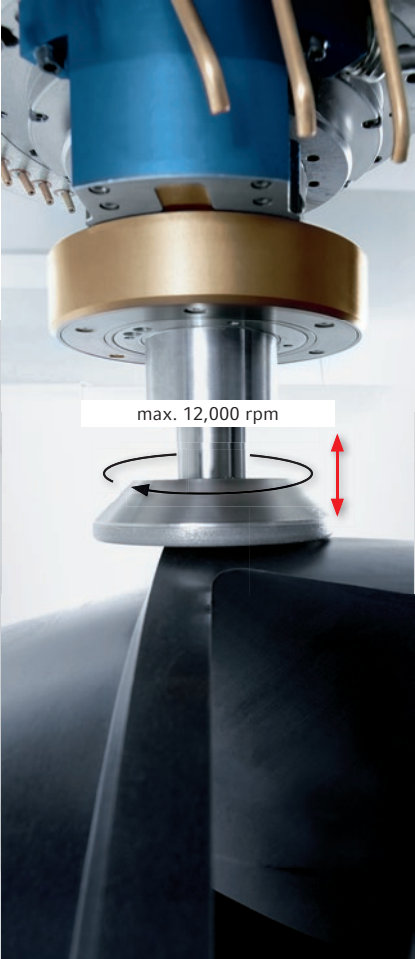




ULTRASONIC  
HSK-32 / -40 actuator system



ULTRASONIC  
HSK-63 actuator system



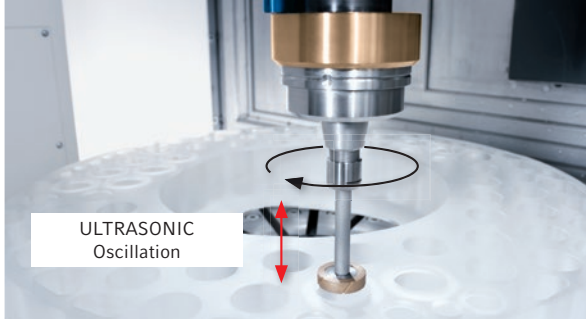
ULTRASONIC  
HSK-100 actuator system

## ULTRASONIC HSK Actuator Systems

		ULTRASONIC HSK-32 / -40 actuator system	ULTRASONIC HSK-63 actuator system	ULTRASONIC HSK-100 actuator system
Machine Types				
		ULTRASONIC 10 (HSK-32)	ULTRASONIC Universal	ULTRASONIC P / FD duoBLOCK®
		ULTRASONIC 20 (HSK-32 / -40)	ULTRASONIC eVo linear	–
		ULTRASONIC 30 (HSK-40)	ULTRASONIC monoBLOCK®	–
		–	ULTRASONIC duoBLOCK®	–
Milling				
Maximum speed	rpm	40,000	24,000	12,000
ULTRASONIC				
Maximum speed	rpm	10,000	8,000	8,000
		40,000*	18,000*	12,000*
Tool Interfaces				
		ER 11 / 16	ER 11 / 16 / 20 / 25	ER 16 / 20 / 25
		14 H 6	20 H 7	20 H 7
easySONIC-Control				
		•	•	•

• Available, \* in conjunction with "Gold Edition" actuator

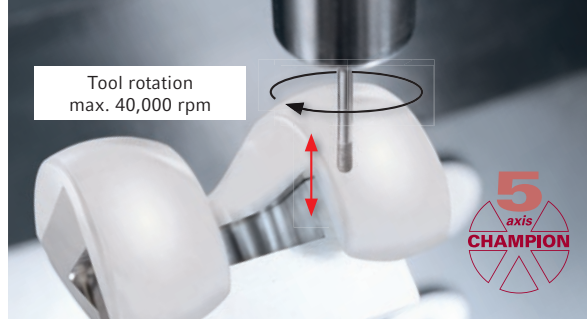




### ULTRASONIC-HSK 4<sup>th</sup> Generation

#### Actuator System

Flexible integration in 5-axis milling centres from DMG MORI (depending on machine type: HSK-32 / -40 / -63 / -100 tool holder).



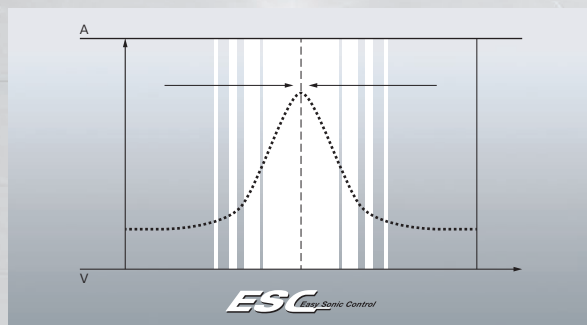
### 5-axis Machine Version

All machines available as a 5-axis version for the ULTRASONIC and (HSC) milling of complex component geometries on one machine.



### Powerful Control System

Uniform control philosophy with 3D contouring control system SINUMERIK 840D solutionline as well as special ULTRASONIC software features.



### Special ULTRASONIC Software Features

Adaptive Control (ADC) for automatic feed adaptation during the machining process as well as easySONIC-Control for automatic frequency recognition.



### Integrated Grinding Package

Grinding packages, specifically matched to ULTRASONIC machining. duoBLOCK® Series machines: Optional with FD technology for demanding cylindrical grinding operations.



### Highly Efficient Coolant Treatment

Toolsmart is a highly compact coolant treatment system, conceptualised for ULTRASONIC machining. Core modules are cooling and temperature control, dosing, filtration and separation.

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ULTRASONIC 10

# With only a 2 m<sup>2</sup> footprint, it is the most compact machining centre from DMG MORI.

The ULTRASONIC 10, with a highly compact footprint of only 2 m<sup>2</sup> offers unique opportunities for the medical / dental industry – from the small laboratory to a large milling centre – for the production of all implant / prosthetics requirements with all materials. With the 5-axis CNC milling centre, SAUER serves the demand for the best possible utilisation of production areas. In addition, comparable applications of the ULTRASONIC 10 can be found in other markets, including the watch industry, precision engineering and tool and mould making.

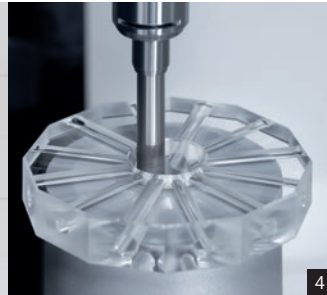
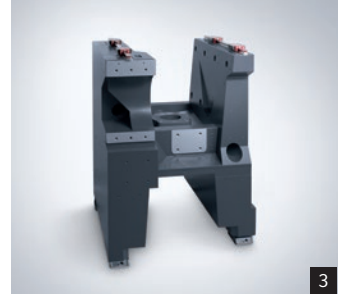


## Highlights

- + Highly compact 5-axis precision machine with a 2 m<sup>2</sup> footprint for milling and ULTRASONIC grinding on one machine
- + High-performance spindle with 40,000 rpm (standard)
- + Integrated swivel rotary table (4<sup>th</sup> / 5<sup>th</sup> axis comes standard) with torque technology, –10 ° / +120 ° swivel range
- + 16× tool changer comes standard (60× chain magazine)\*
- + Standardised Automation Solutions
- + User-friendly Siemens 840D solutionline CNC control system with easySONIC-Control (comes standard)

\* Option



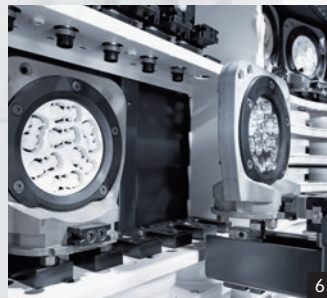


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- 1: Work area of the ULTRASONIC 10 with an integrated NC swivel rotary table
- 2: Laser tool measurement and automatic tool changer
- 3: Compact, inherently rigid mineral cast frame in the monoBLOCK® design
- 4: Complete machining of glass components in < 10 minutes
- 5: Precision machining of a gear made of hiped zirconium oxide

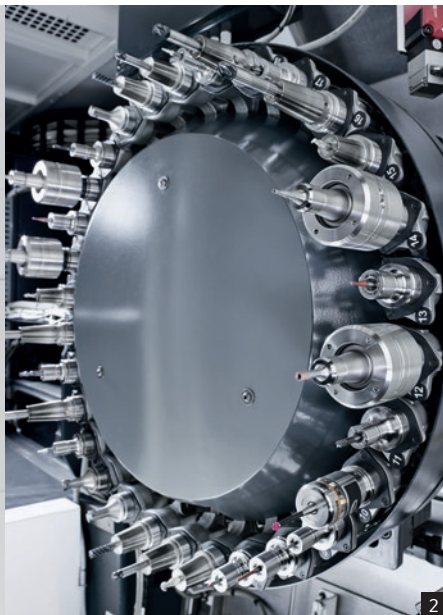
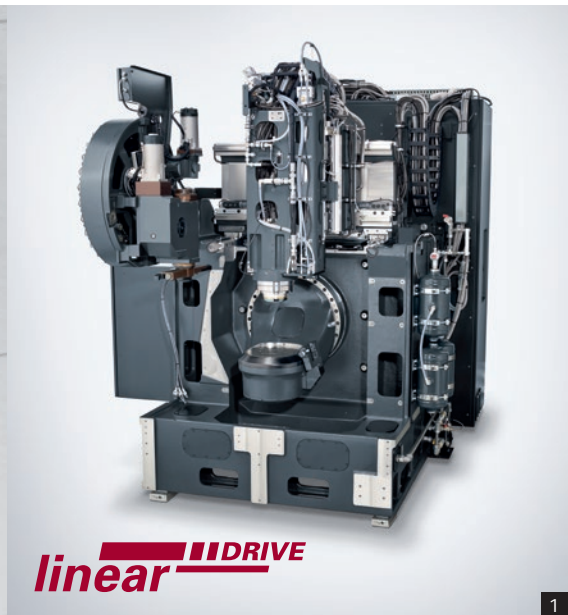


- 6: Depositing a pallet in the rotary storage (example: dental)
- 7: Inserting a pallet in the work area (example: dental)



## PH 2|120 Linear Magazine

- + Compact, integrated linear magazine
- + Loading / unloading of raw material and finished parts during machining
- + Unmanned production in multiple-shifts
- + Separation of parts in the finished part storage
- + Automation can be flexibly configured (5 options)
- + Job management system for easy order management



- 1: High-precision, long-term stable gantry design with linear drives in X / Y / Z
- 2: 30x tool magazine with a double gripper (comes standard) (optional: 60x / 120x)
- 3: 5-axis precision machining of watch components made of zirconium oxide and sapphire
- 4: Complete machining of high-precision optical components
- 5: NC swivel rotary table with torque technology and  $\pm 120^\circ$  swivel range (B-axis)
- 6: Temperature control of all precision-related machine components

## Highlights

- + High-precision, long-term stable gantry design (dual drive in the Y-axis) with comprehensive temperature management: temperature control of the machine bed, all drives and guides, the switching cabinet as well as all media, with constant temperature monitoring
- + Highly dynamic, actively cooled linear drives in X, Y, Z with up to  $> 1.2g$  and 50 m/min rapid traverse
- + Flexible 5-axis simultaneous machining through to rotary / swivel table with optimal swivel range of  $\pm 120^\circ$  in the B-axis
- + 19 kW motor spindle with shaft cooling and rotary feed-through with HSK-E40 and 40,000 rpm (standard)
- + 30x tool magazine with double gripper (optional: 60 / 120 tools, chain magazine)
- + Standardised automation solutions for an efficient production process in multi-shift operation
- + 3D control system Siemens 840D solutionline with Operate 4.5 and DMG ERGoline® Control\*

\* as of 2014 / 2015 available with CELOS

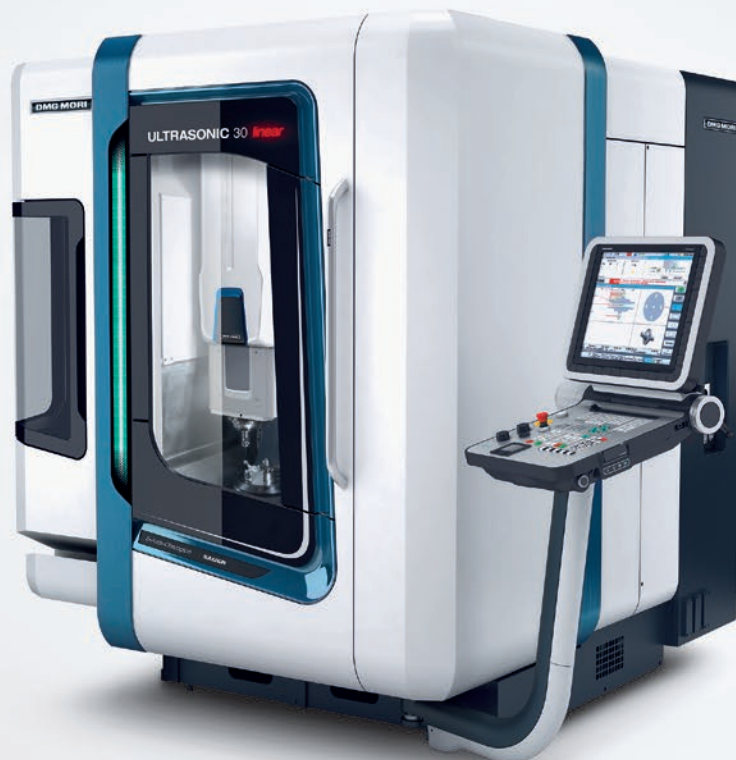


ULTRASONIC 30 *linear*

## Maximum contour precision and surface quality of $Ra < 0.1 \mu m$ for advanced materials.

With its high-precision, long-term stable gantry construction and comprehensive temperature control of all precision-related machine components, the ULTRASONIC 30 *linear* offers new options for 5-axis precision machining of advanced materials. The application focus is on dimensional accuracy, contour precision and surface quality of  $Ra < 0.1 \mu m$  for ULTRASONIC grinding of complex geometries in high-performance materials for the optical / watch / medical industries as well as precision mould making. The highly dynamic, actively cooled linear drives in X, Y, Z with up to  $> 1.2g$  acceleration and 50 m/min. rapid traverse, 40,000 rpm (standard) as well as the optimal swivel range of  $\pm 120^\circ$  in the B-axis, underpin the outstanding performance of this innovation.

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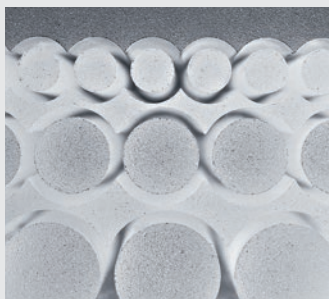
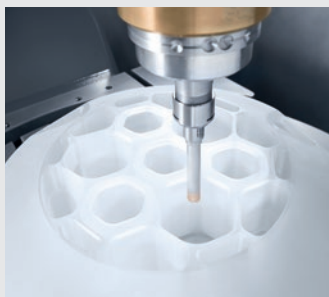
**linear** **II DRIVE**



Optical Industry

## Under the magnifying glass – perfect results for the optical industry.

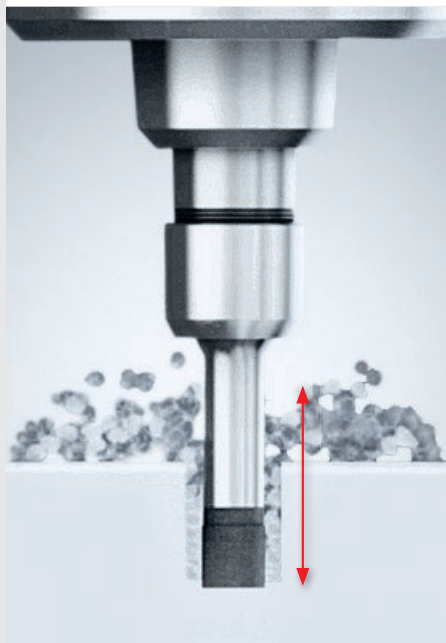
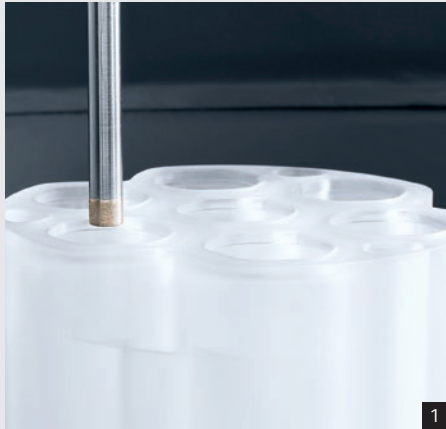
The application areas of the ULTRASONIC technology for optical industry are broad. High-precision deep hole drilling, demanding component geometries in glass, mirror supports with thin-walled light weight structures of Zerodur or rod lenses of corundum for scanner systems and endoscopy are typical applications. In this way, the ULTRASONIC Series has already advanced into the fields of projection and measurement optics, satellite construction, the manufacture of optical levelling systems and other technical and scientific application fields. The manufacture of pressing tools / moulds made of carbides and ceramics rounds off the application field of the ULTRASONIC in this industry.



### ULTRASONIC Benefits

- + Reduced process forces result in less sub-surface damaging
- + Feasibility of thin webs with  $< 0.5 \text{ mm}$  wall thickness
- + Excellent surface quality with  $Ra < 0.1 \text{ } \mu\text{m}$  possible
- + Feasibility of deep hole drilling of up to  $25 \times \varnothing$
- + Everything on one machine: drilling, grinding of pockets and grooves, surface contours

## ULTRASONIC Machining Strategies



### **1** ULTRASONIC Drilling

with longitudinal  
movement kinematics



### **2** ULTRASONIC Grinding

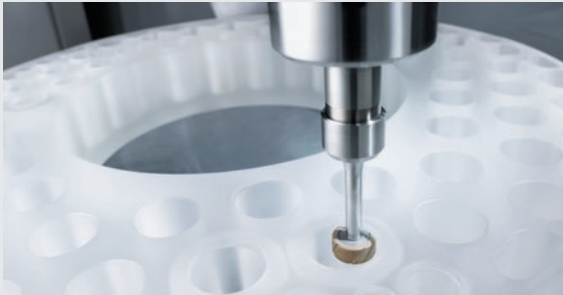
of a pocket with undercut  
with cross-side vibration



### **3** ULTRASONIC Face Grinding

with tilted cup grinding wheel  
with cross-side vibration

# Application Examples



ULTRASONIC 100 P duoBLOCK®	
Complete machining of light weight structures for mirror supports of Zerodur	
Industry	Satellite construction / telescopes
Material	Zerodur (glass ceramics)
Tools	Diverse diamond drill / grinding tools
Machining	Creating pockets with undercut and thin walls (light weight structures)



ULTRASONIC 20 linear	
Deep hole drilling in glass	
Industry	Optics
Material	BK-7 (optical glass)
Tools	1 hollow drill
Machining	Through-hole drilling ø 4 x 22 mm in 19 seconds per drill hole



ULTRASONIC 50-5 linear	
Filigree contour with radial drilling in glass	
Industry	Optics
Material	BK-7 (optical glass)
Tools	3 (diamond hollow drill / grinding pins)
Machining	Full machining in 17 machining steps in 70 minutes



ULTRASONIC 50	
Thin walls with < 0.5 mm in glass	
Industry	Optics
Material	Zerodur (optical glass)
Tools	5 (diamond hollow drill / grinding pins)
Machining	Feasibility of threads and thin webs with wall thickness < 0.5 mm





## Optical Industry

Mirror supports with thin-walled webs and other complex geometries in Zerodur, high precision deep hole drilling in gyroscopes or rod lenses of corundum / optical glass for scanner systems / endoscopy are typical ULTRASONIC applications. In this way the ULTRASONIC series has successfully entered the fields of projection and measurement optics, satellite construction and optical component manufacturing.

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Applications and Parts

Machine and Technology

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**Application Areas**

- High Performance Ceramics
- 

Control Technology

Application Technology

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Technical Data

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## High Performance Ceramics

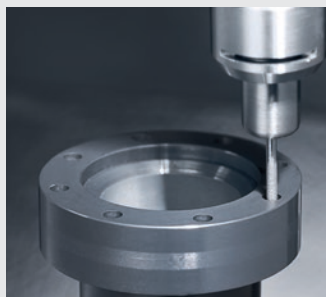
The demand for longer tool service life, increased productivity and component quality makes the use of advanced materials unavoidable. Ceramic high-performance materials, like SiC, silicon nitride ( $\text{Si}_3\text{N}_4$ ) or hiped zirconium oxide ( $\text{hip-ZrO}_2$ ) as well as the demand for ever more complex geometrical shapes, require high performance and economical machining procedures. This is exactly where the ULTRASONIC technology offers a competitive advantage.



## Can be used universally, is wear-resistant and durable.

Where conventional materials quickly reach their limits, everywhere where extreme loading due to chemicals, high temperatures, friction forces or current are present, even within the human body – this is where the wear-resistant and durable products made from technical ceramics find application. The application fields reach from ceramics components for pumps / valve parts, the textile industry, the semi-conductor / automotive / aerospace industry up to everyday consumer goods in our immediate vicinity.

If highest demands are placed on shape contours, materials and surface structure, the ULTRASONIC Series is exactly the right solution for you. Especially when quality may not be at the expense of production costs, or when complex shapes must be created by means of grinding, drilling or milling in the shortest period of time.



### ULTRASONIC Benefits

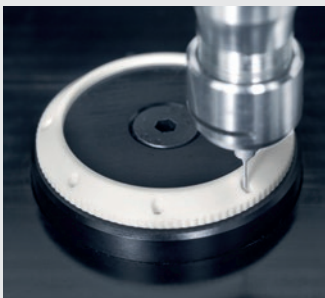
- + Economic, shaping hard machining of sintered, even hipped ceramics – also of difficult to machine non-oxide ceramics like SiC, Si<sub>3</sub>N<sub>4</sub>
- + Excellent surface quality of Ra < 0.2 µm is possible (depending on the ceramic grit) for direct machining or finishing of pre-sintered ceramic components that are defined as oversized
- + Feasibility of free form surfaces
- + Universally applicable for the most diverse machining tasks from drilling to complex geometries



Watch industry / precision engineering

## Symbiosis of precision, functionality and aesthetics.

The application of watch housings, bezels and crowns made of black, scratch-resistant zirconium oxide, dials made of ceramics or mother-of-pearl, as much as the integration of relevant watch components made of sapphire, ruby or glass ceramics, have already been established in the manufacturing scope of luxury watches. Besides the numerous positive, material characteristics, these high performance materials excel with aesthetics, functionality and long service life. This is exactly where the ULTRASONIC 10 as well as the new 5-axis precision machine ULTRASONIC 30 *linear* excel with many machine features like precision, dynamics, stability and flexibility.



### ULTRASONIC Benefits

- + High-quality ULTRASONIC precision machining of black zirconium oxide, sapphire and glass ceramics: creating miniature drill holes, grooves, pockets and free form surfaces
- + All-in-one: The technology combination of ULTRASONIC and high-speed cutting, with up to 40,000 rpm on a 5-axis precision machine, allows the machining of all watch component materials
- + Standardised automation solutions with highly compact linear magazine handling
- + Surface quality  $Ra < 0.2 \mu m$  and component precision  $< 10 \mu m$  possible



## Watch industry / precision engineering

The use of the innovative ULTRASONIC technology for watch components made of zirconium oxide, sapphire or glass ceramics is crucial. Numerous renowned manufacturers of luxury watches manufacture intricate components on ULTRASONIC machines from DMG MORI.

## Medical Technology

Hardly any other industry continuously shows growth like the medical technology, especially in the sector of orthopaedic implants. Precision and surface quality are probably the most important component criteria for this industry. The new ULTRASONIC 30 *linear* 5-axis precision machine is well suited for this industry and can even machine PMMA through titanium up to hipped zirconium oxide.

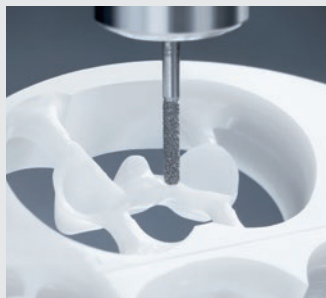




## Progress for health – better implants for healthier patients.

Extreme precision and achievement of defined surfaces in the machining of advanced materials is an important prerequisite for the manufacture of medical products. High performance materials are not only used in the manufacture of orthopaedic and dental implants, but also in magnetic resonance tomography, X-ray technology and in the manufacture of medical equipment.

As a result of the low process forces of ULTRASONIC machining, deep material damage is avoided and the open pore structure of specific implant materials is guaranteed.



### ULTRASONIC Benefits

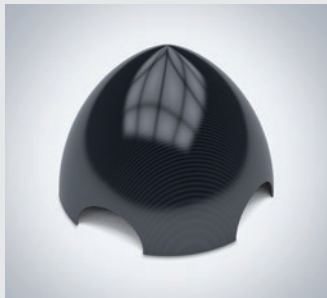
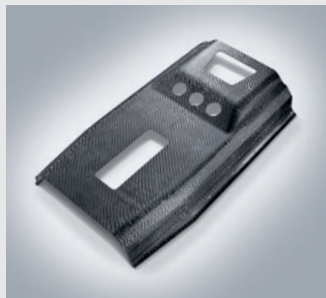
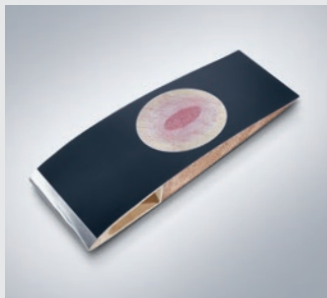
- + Unrivalled wide spectrum of materials, from PE – through titanium – up to hiped zirconium oxide: all dental and medical applications in all materials
- + Highest contour and fit accuracy as well as excellent surface quality of  $Ra < 0.2 \mu m$
- + Reduced process forces for less depth damage in the material as well as retention of the open pore structure
- + Universally applicable for the most diverse machining tasks from drilling to complex free forms

#### Composites / fibre composites

## Double feeds and reduced process forces thanks to ULTRASONIC.

Fibre composites are ideally suited for the production of lightweight components, due to their high strength and minimal weight. The use of CFRP and GFRP in civil aviation continues to grow and all premium manufacturers in the automotive industry produce important structural components out of fibre reinforced plastics. Even in the field of wind energy, all aerodynamic components today are made of composite materials. In addition to the actual production applications, there is also an ever-growing demand for automated, economical machining options for maintenance and repair (repair & rework) of damaged fibre composite components.

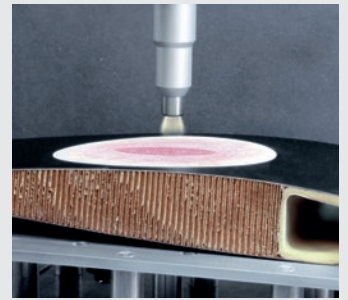
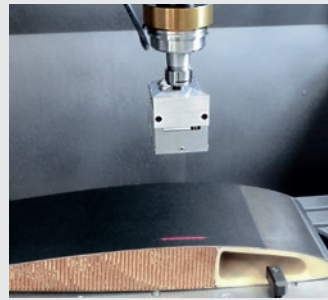
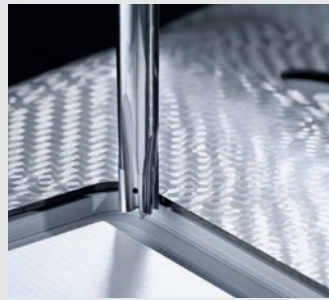
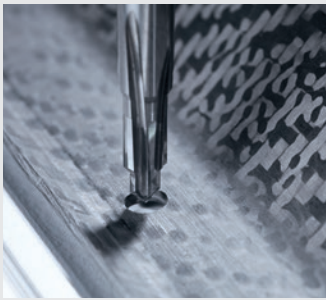
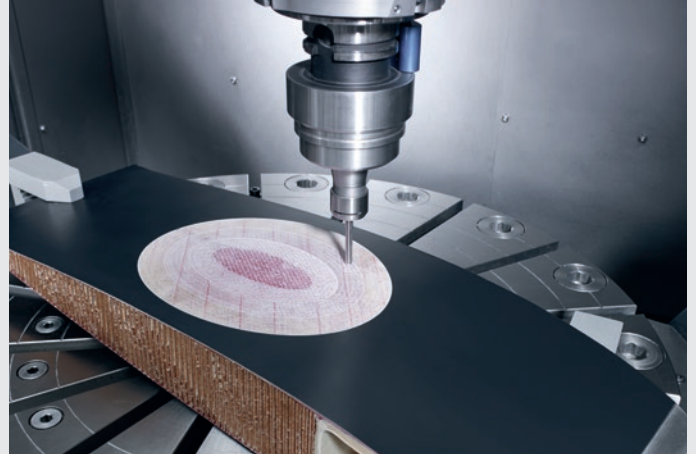
In both cases, the use of ULTRASONIC technology along with SAUER's comprehensive process approach, offers a breakthrough solution for very efficient machining of these high-performance materials with optimal component quality.



### ULTRASONIC Benefits

- + Up to 40 % reduced process forces to prevent delamination and fibre tearing
- + Double feeds possible through ULTRASONIC
- + Longer tool life by preventing built-up edges
- + Optimal particle removal from the active zone
- + Excellent component quality: sharp edges, clean exposure of individual laminate layers, perfect surfaces

## Two segments: Serial production and repair & rework



### Serial production

#### Trimming and drilling of CFRP / GFRP / AFRP components in serial production

- + Trimming with optimal surface quality without chipping or chatter marks for the subsequent joining process
- + Creation of drill holes or rivet holes with the best possible roughness values in the channel, diameter tolerances in the  $\mu\text{m}$  range as well as reduced chipping on the drill entry and exit side
- + Feasibility of through-hole and blind hole drilling, threads, grooves, pockets and other geometric free forms
- + Full cut machining without fibre tearing or de-lamination

### Repair & rework

#### Scarfig by means of accurate exposure of individual laminate layers

- + Full cut scarfig without fibre tearing or de-lamination
- + Reverse engineering: Integrated laser scanner for surface recognition, feedback and measuring
- + Integrated atmospheric pressure plasma: Surface activation / cleaning for optimal preparation for subsequent reconstruction processes
- + Stationary as well as mobile (special request) possible



# Machine adaptation and process optimisation



## Basic Machine Design

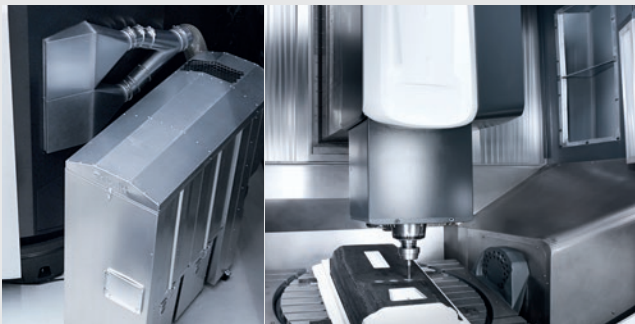
- + Rigid and thermo-symmetrical machine design for maximum precision during continuous operation
- + All drives and guides (except for the Y-axis) are encapsulated outside of the machining area
- + Specially adapted COMPOSITE milling spindle with permanent grease lubrication with 18,000 rpm (24,000 / 35,000 rpm)\*

\* Option



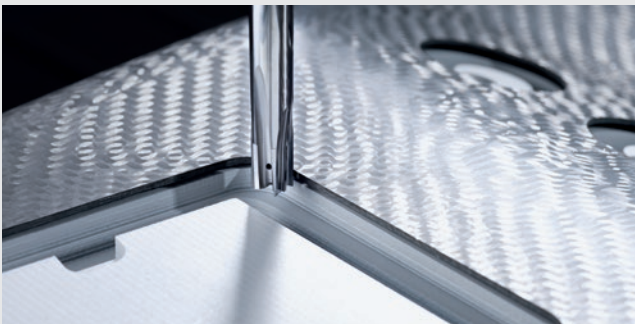
## 5-axis and device design

- + Integrated technology framework: Dynamic machining through the gantry drive in the A-axis combined with the B-axis swivelling head (5-axis machining)
- + Weight-optimised device design: Simple, ergonomic loading and unloading through vacuum clamping and a rotating device



## Extraction design

- + Deal for the integrated room extraction design through the enclosed work area
- + High-performance extraction design with integrated fine particulate monitoring, as well as heat recirculation
- + Explosion-proof filter system with stable filter performance



## Tool design

- + Optimal tool design: Use of very abrasive and viscous materials; different materials in the core and outer layers
- + Tool change on demand: the self-teaching system monitors the process even for varying process forces (integration in HMI and control system)



## Composites / fibre composites

ULTRASONIC starts where conventional machining processes reach their technical limits: double feeds, clean edges, no fibre tearing or delamination, optimal surfaces, prevention of build-up edges and a comprehensive extraction concept with fine particulate monitoring – these are only the most obvious highlights of this technology innovation.



## ULTRASONIC Series

# Advanced CNC control technology for perfect ULTRASONIC performance.

All machines\* of the ULTRASONIC generation are equipped with the DMG ERGOLine® Control featuring a 19" screen and are available with the Siemens 840D solutionline. Special ULTRASONIC software tools like ADC and easySONIC support user-friendly and target-oriented ULTRASONIC machining and have a direct influence on work piece quality and process safety.

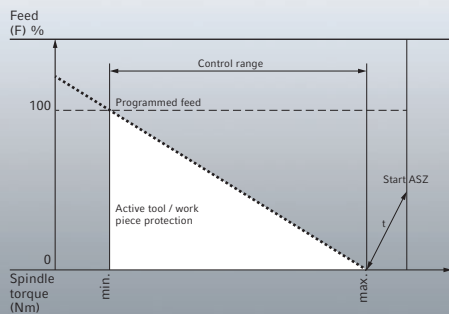
\* except for: ULTRASONIC 10 with SLIMline® panel and 15" screen



## Siemens 840D solutionline

- |   |   |
|---|---|
| <p><b>1 Screen tilt:</b><br/>continuously adjustable from 5–30°</p> <p><b>2 Screen surface:</b><br/>easy to clean, flat screen surface</p> <p><b>3 DMG SOFTkeys®:</b><br/>programmable short cut keys for frequently used screen contents or user sequences</p> | <p><b>4 Keyboard tilt:</b><br/>continuously adjustable from 15–70°</p> <p><b>5 DMG SMARTkey® with transponder:</b><br/>customised authorisation of user with relevant access rights to the control system and machine</p> |
|---|---|

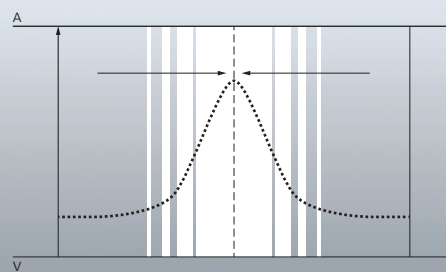




**ADC** *Adaptive Control*

### ADC – Adaptive Control

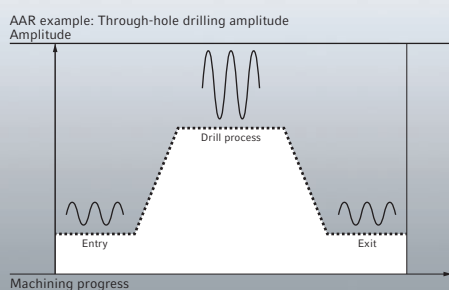
- + Automatic feed adaptation during the machining process
- + Control variable: Spindle torque in Nm
- + Definition of a minimum value and a maximum value: If the max. value is exceeded the feed is automatically reduced and damage to the work piece or the tool is thereby prevented
- + Standard for all ULTRASONIC machines



**ESC** *Easy Sonic Control*

### easySONIC-Control

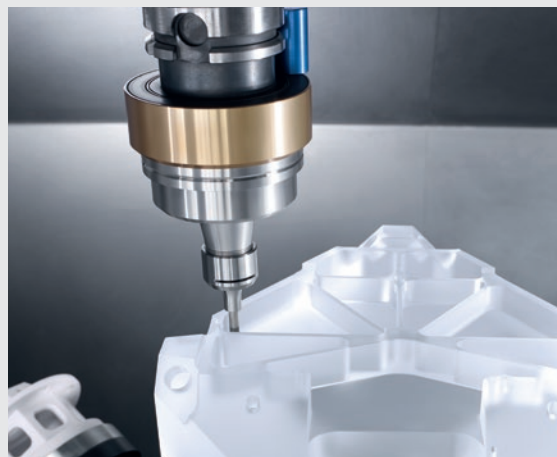
- + Automatic ULTRASONIC frequency recognition for all ULTRASONIC-HSK actuators of the 4<sup>th</sup> generation (automatic scan to determine the resonance frequency / optimal working frequency)
- + No action by the machine operator required, uniform interface for the operator, irrespective of machine type
- + Simplified operator interface clearly shows the essential functions and parameters
- + Standard for 4<sup>th</sup> generation (optionally available as retro-fit kit)



**AAR** *Automatic Amplitude Regulation*

### AAR – Automatic Amplitude Regulation

- + Integration of a special amplitude cycle in the CNC programme (allows the utilisation of different amplitudes within a specific machining task)
- + Optionally available for all ULTRASONIC machines



### Upgrade to high speed actuators

- + Upgrade of your installed ULTRASONIC machine to the latest, performance-optimised high speed actuators
- + Higher cutting speed thanks to higher speed at the work piece:
  - max. 40,000 rpm with HSK-E32, HSK-E40
  - max. 18,000 rpm with HSK-A63
  - max. 12,000 rpm with HSK-A100

## ULTRASONIC

Creation of complex geometries  
in advanced materials

The reduced process forces due to the use of ULTRASONIC technology allow the manufacture of thin-walled webs and other complex geometries in demanding technical components of Zerodur and high-performance ceramics. Depending on the condition of the material, surface qualities of  $Ra < 0.2 \mu m$  can be achieved.







1: View of the  
ULTRASONIC showroom  
2: SAUER ULTRASONIC  
in Stipshausen  
3+4: ULTRASONIC  
technology seminars  
in the showroom



## ULTRASONIC excellence

- + More than 30 years experience in machining hard-brittle and difficult to machine materials
- + More than 400 installed ULTRASONIC machines (worldwide)
- + Strong, competent team of application engineers
- + Feasibility studies, process development / optimisation, complete turn-key solutions

### ULTRASONIC Series

# Expert advantage in ULTRASONIC machining of advanced materials.

Take advantage of the technical expertise of our competent team of application engineers and the numerous unique selling points of the ULTRASONIC Series – visit SAUER ULTRASONIC in Stipshausen. Besides the actual production of machines, SAUER support their customers with feasibility studies, process optimisation and turn-key technology solutions by SAUER's development and application department. In addition SAUER GmbH regularly organises ULTRASONIC technology seminars for customers and interested parties on the demonstration machines in a modern ULTRASONIC showroom.



5: The SAUER LASERTEC location in Pfronten represents itself with 5-axis laser machining machines in the four technology fields Shape (3D machining, texturing), PrecisionTool (PCD / CVD-D / CBN precision tools), FineCutting (3D fine cutting parts) and PowerDrill (turbine components).

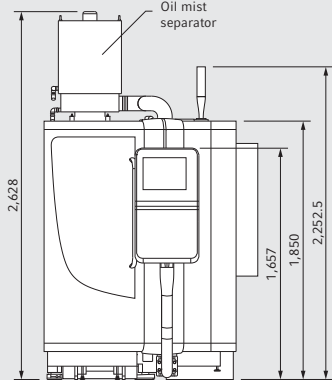


ULTRASONIC Series

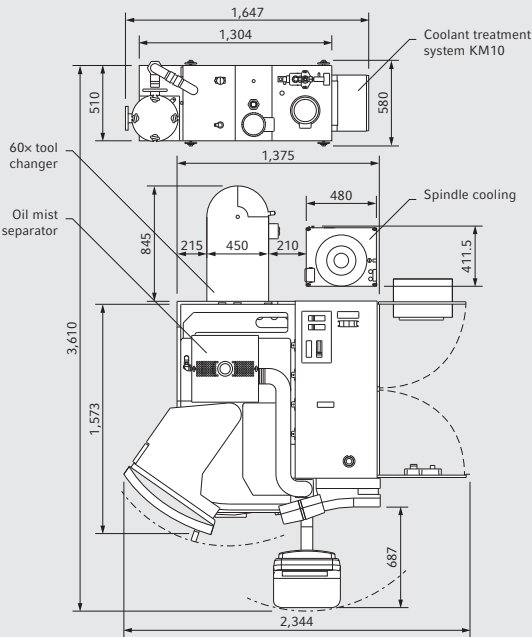
Floor plans

Floor plan for ULTRASONIC 10

Front view



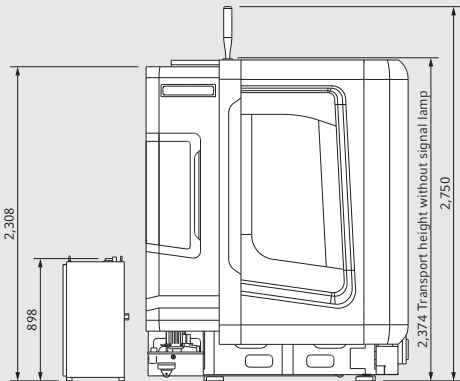
Top view



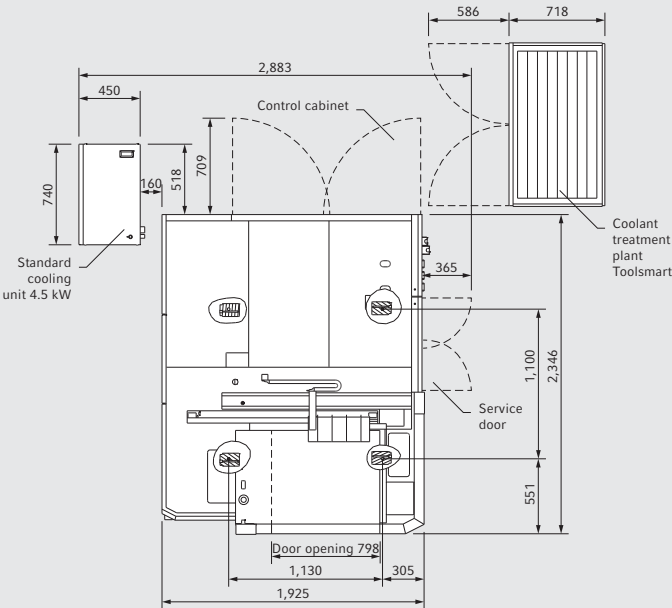
Presentation of floor plans with optional swivel rotary table, 60x tool changer and oil mist separator

Floor plan for ULTRASONIC 30 linear

Front view



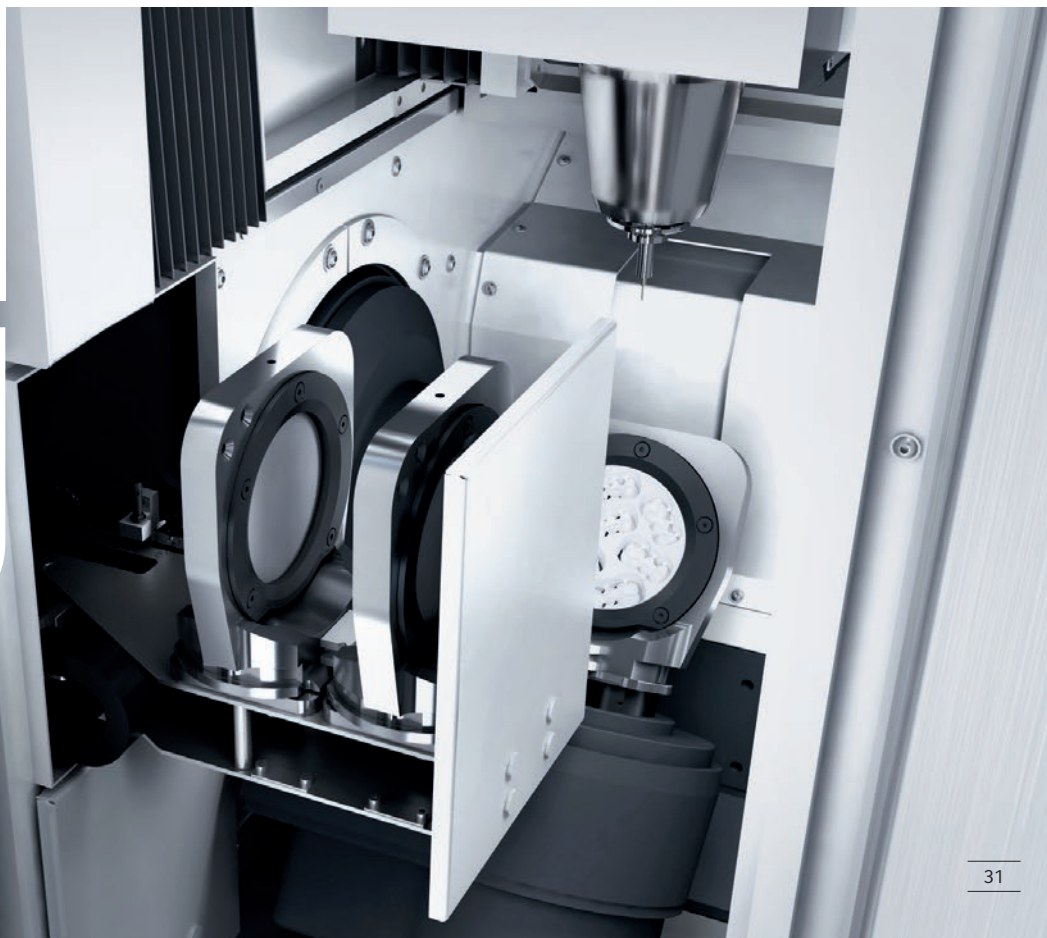
Top view



Presentation of floor plans with optional swivel rotary table

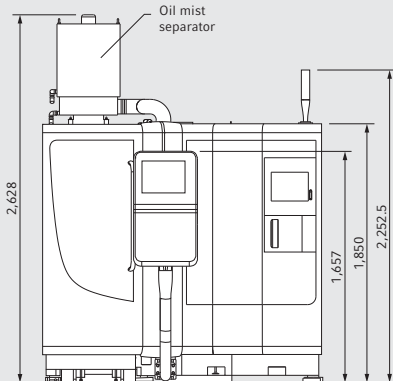
## Standardised automation solutions

Besides the PH 21120 linear magazine, the ULTRASONIC 10 is optionally available with an integrated 4x pallet handling system (see figure). All other ULTRASONIC machines are available with standardised automation solutions (pallet or work piece handling systems).

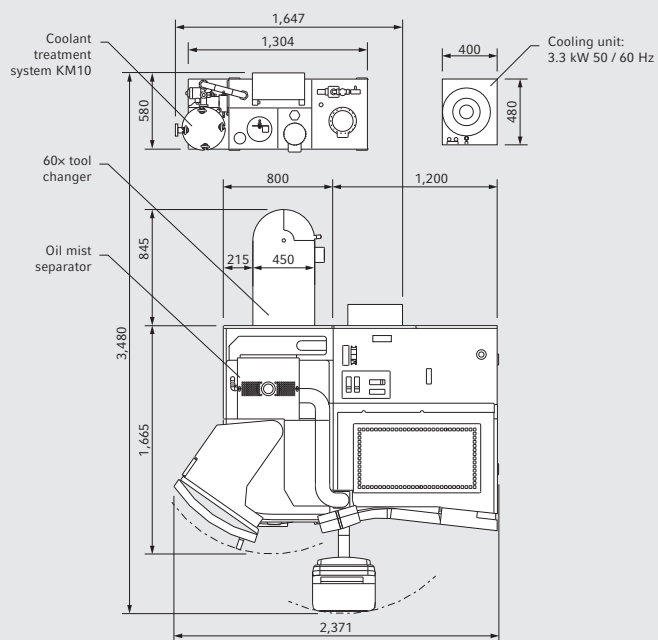


### Floor plan with automation featuring PH 21120 (ULTRASONIC 10)

Front view



Top view



Floor plans of the HSC linear / eVo linear / monoBLOCK® / duoBLOCK® machine versions in the relevant product brochures

## ULTRASONIC Series

# Technical Data

		ULTRASONIC 10	ULTRASONIC 30 <i>linear</i>
<b>Traverses</b>			
X- / Y- / Z-axis	mm	120 / 120 / 200	320 / 300 / 280
A- / B-axis	Degrees	–10° to 120°	±120°
C-axis	Degrees	360°	360°
<b>Main drive</b>			
Max. speed range ULTRASONIC	rpm	40,000	40,000
Max. speed range milling	rpm	40,000	40,000
Positioning accuracy in X / Y / Z	µm	P10	P5
Repeatability accuracy in X / Y / Z	µm	P8	P3
<b>Feed</b>			
Feed range up to	mm/min	10,000	12,000
Rapid traverse X / Y / Z	m/min	10	50
<b>Working table</b>			
Clamping surface rigid table	mm	–	400 × 380
Max. table load	kg	–	200
Clamping surface NC swivel rotary table	mm	ø 190	ø 250
Max. table load	kg	10	80
Max. speed of rotational axes (A / B / C)	rpm	100 / 150	100 / 100
Positioning accuracy (A- / B- / C-axis)	"	±5	±5
<b>Tool</b>			
Tool holder spindle	Type	HSK-32	HSK-40
Tool magazine (standard / optional)	Positions	16 (60 chain magazine)	30 (60 / 120 chain magazine)*
Type – tool magazine (standard)	Type	Changer wheel (horizontal)	Changer wheel (vertical)
Max. tool length at full capacity and max. speed	mm	130	250
Max. tool diameter at full capacity and max. speed	mm	30	66
Chip-to-chip time	s	15	6
<b>Options</b>			
Work piece measurement	Type	DMG PP-400	DMG PP-400
Tool measurement	Type	RS NC-4	Blum NT, RS NC-4
Coolant treatment system	Type	KM10, Toolsmart	Toolsmart
<b>Floor plan and connection data / basic machine</b>			
Floor space	m²	< 2	< 4.6
Dimensions L / W / H (incl. signal lamp)	mm	1,775 / 1,530 / 2,253	2,346 / 1,925 / 2,750
Footprint L / W / H (incl. access to all service doors)	mm	4,100 / 3,700 / 2,300	4,400 / 4,200 / 2,800
Weight	kg	1,800	6,800
Power rating	kVA	25	54
Operating voltage / max. fuse rating	V	400 (N/PE) / 50 A	400 (N/PE) / 100 A
Required compressed air connection	bar	6	6
Average air consumption	m³/h	20	70
<b>Control Systems</b>			
DMG SLIMline® Control with 15" screen		Siemens 840D solutionline	–
DMG ERGOline® Control with 19" screen		–	Siemens 840D solutionline

\* When using ULTRASONIC tool holders, only every second magazine position can be occupied.  
The intermediate positions can be used with conventional HSK holders.

Technical data of the HSC *linear* / eVo *linear* / monoBLOCK® / duoBLOCK® machine versions in the relevant product brochures.

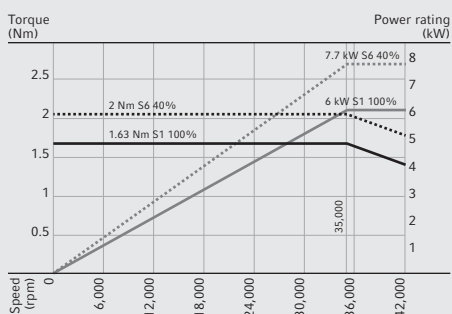


		PH 214	PH 2120
<b>Automation</b>			
Available for		ULTRASONIC 10	ULTRASONIC 10
Automation type	Type	Integrated blank automation 4-fold	Linear magazine
Max. handling weight	kg	2	2
Tool change time	s	≤ 30	≤ 55
<b>Integrable pallet types</b>			
Blank automation holder (BH)		Yes	Yes
Max. number		4	13
Glass ceramics holder (GCH)		No	Yes
Max. number		–	50 / 250*
Finished parts storage (FPS)		No	Yes
Max. number		–	150
Base configuration (BH / GCH / FPS)		4 / – / –	10 / – / 150
Mixed operation		No	Yes
Option 2 (BH / GCH / FPS)		–	10 / 50 / 100
Option 3 (BH / GCH / FPS)		–	– / 150 / –
Option 4 (BH / GCH / FPS)		–	28 / 12 / 60
Option 5 (BH / GCH / FPS)		–	34 / 39 / –
<b>Floor plan data / basic machine and automation</b>			
Floor space	m <sup>2</sup>	< 2	< 4
Dimensions L / W / H (incl. signal lamp)	mm	1,775 / 1,530 / 2,253	1,775 / 2,000 / 2,253
Footprint L / W / H	mm	4,100 / 3,700 / 2,300	4,100 / 4,000 / 2,300
Weight	kg	1,900	2,700
Job management system		No	Yes



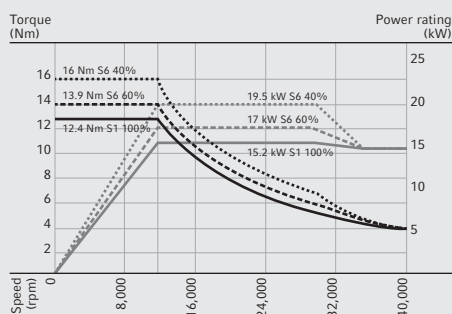
#### Motor spindle HSK-32

42,000 rpm / 7.7 kW / 2 Nm



#### Motor spindle HSK-40

40,000 rpm / 19.5 kW / 16 Nm



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