



Highest productivity without limits

# KERN Micro<sub>HD</sub>



## STUNNING SURFACES

and absolute accuracy



## INCREDIBLE DYNAMICS

and unmatched repeatability



## HIGHEST PRECISION

and long-term stability

# KERN Micro<sub>HD</sub>

The new standard in precision manufacturing

With the newly developed **micro-gap hydrostatics**, the **linear drives** and the advanced **KERN temperature management**, the KERN Micro HD is the new benchmark in **precision, long-term stability and dynamics**. Together with the know-how of our customers and the KERN application technology, the KERN Micro HD is unmatched.

The KERN Micro HD is the solution for high-precision serial - and prototype - production and when the question comes up whether production is still possible. This system is based on the second generation of KERN Micro, which was launched in 2019, and relies on proven, high-quality KERN technology. It provides absolute reliability and stability over a long machine life. The new KERN micro-gap hydrostatics is combined with the powerful linear motor drives in the integral axis system. This combination creates a unique drive system

that sets new standards in precision, stability, dynamics and freedom of wear. The KERN Micro HD works more accurate and more productive than other 5-axis milling machines when the demands become extreme. With hydrostatic, direct drives and a unique design this compact system can easily meet the highest requirements. This results in highest availability, maximum output rate and minimum reject rate, as well as low maintenance costs, versatile and flexible applications and a significant competitive advantage for the user.



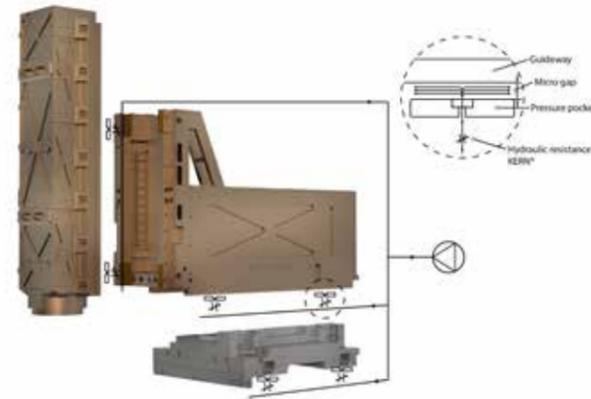
### AT A GLANCE

- Compact design and small footprint of less than 54 sqft/5 m<sup>2</sup>
- Supreme machine stability with advanced KERN temperature management
- High dynamics and productivity through integrated linear motor drives
- Best quality and wear-free due to innovative KERN micro-gap hydrostatics
- Multi-shift operation with no need for operator with integrated changer for up to 210 tools and a maximum of 60 workpieces
- Certified interfaces for additional accessories and automation systems
- Management and maintenance during operation without interruption while machine is running

” The **KERN Micro<sub>HD</sub>** embodies the technology for manufacturing at the limit of what is feasible. Our system for highest possible precision, quality and stability. “

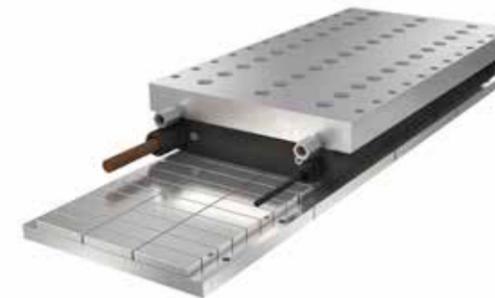
### Innovative KERN micro-gap hydrostatics

The KERN hydrostatics with micro-gap is an absolute novelty in mechanical engineering and, compared to conventional hydrostatic systems with only 5 µm gap height, it is particularly energy-saving. The micro-gap also ensures the highest possible rigidity and perfect damping properties, which can be seen and measured in the surface quality and the accuracy of the work-piece. The actively temperature-controlled aluminium axes and the hydrostatic fluids guarantee a maximum stability even under non-ideal conditions. This also guarantees a consistently perfect quality of workpieces in serial operation. The new axes system was developed over three years and tested under real conditions in our contract machine shop, where it was optimized until it overcame all existing standards.



**Hydrostatics**  
All linear axes of the KERN Micro HD are equipped with the latest KERN micro-gap hydrostatics

### Linear direct drive



**Linear direct drives**  
The integral design of micro-gap hydrostatics and linear direct drives allow supreme precision and high dynamics at the same time

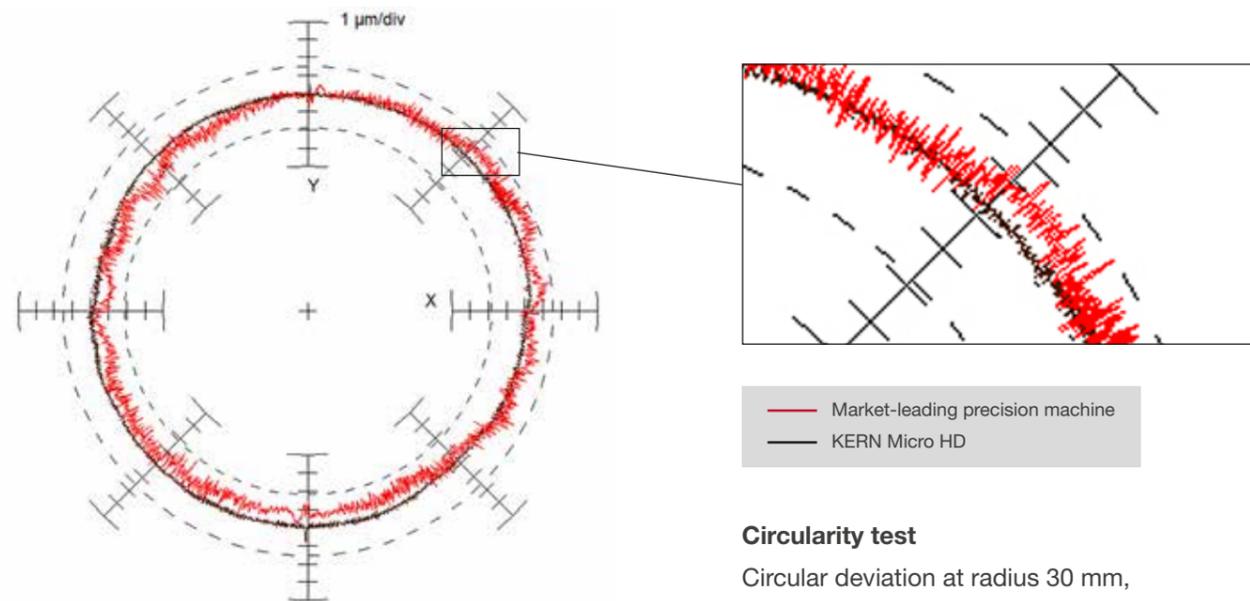
Linear motors are a popular drive system in machine tools with advantages in terms of dynamics and control accuracy. However, due to the enormous heat input, the system was only of limited suitability for high-precision machines. In the new KERN Micro HD, KERN installs high-quality, large-dimensioned and actively temperature-controlled linear motors for a supreme drive of the axes in integral design. This integration into the hydrostatic system consistently minimizes the heat input and thus eliminates unwanted side effects. The combination of KERN micro-gap hydrostatics and linear motors is unique and unmatched in its performance.

#### THE BENEFITS AT A GLANCE

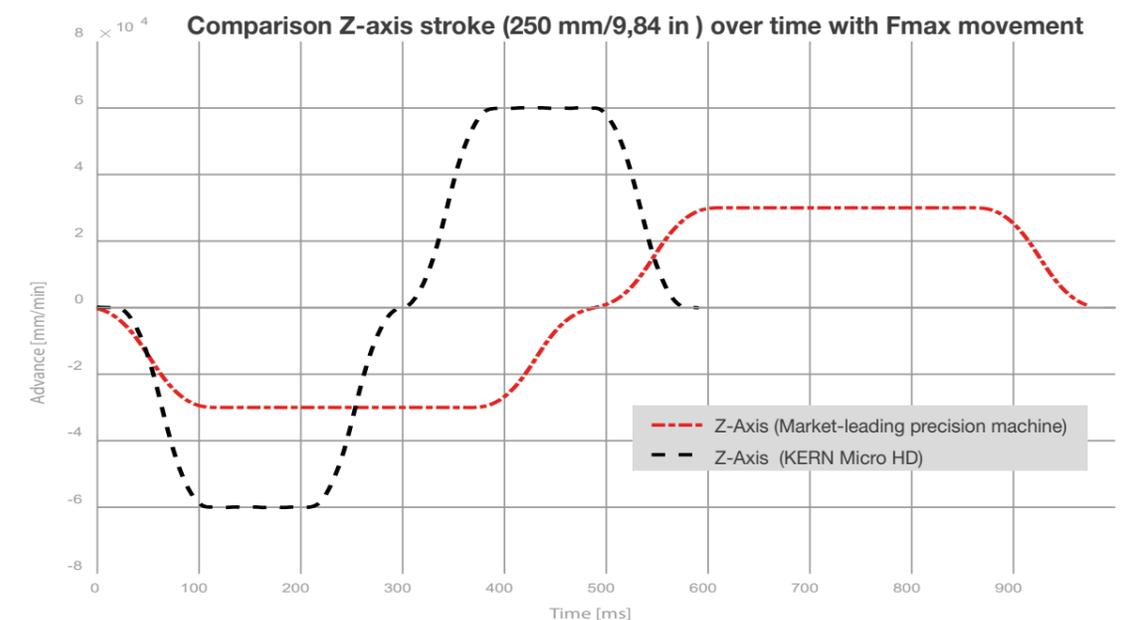
- **Short cycle times** due to high dynamics, improved roughing performance and high cutting depths
- **Best possible surface quality** due to supreme damping and slip-stick-free tool movements
- **Highest possible availability** of the machine due to long-term stability and wear resistance
- **Reduced energy costs** due to micro-gap hydrostatics, saving approx. 80% energy
- **High repeatability** and reduction of reject rate because flood coolant is temperature controlled
- **Highest part precision** due to an extremely high positioning accuracy
- **Great ergonomics** and intuitive operation, noise is reduced to a minimum

#### THE BENEFITS AT A GLANCE

- **Short cycle times** due to highly dynamic behaviour in acceleration and traversing speed
- **Best possible surface finish** and elimination of reverse marks because of unsurpassed reversal behaviour
- **Highest possible availability** due to long-term stability and wear resistance
- **High repeatability** and minimal rejects due to intelligent temperature control
- **Highest precision** on the part due to highest positioning accuracy and contour accuracy



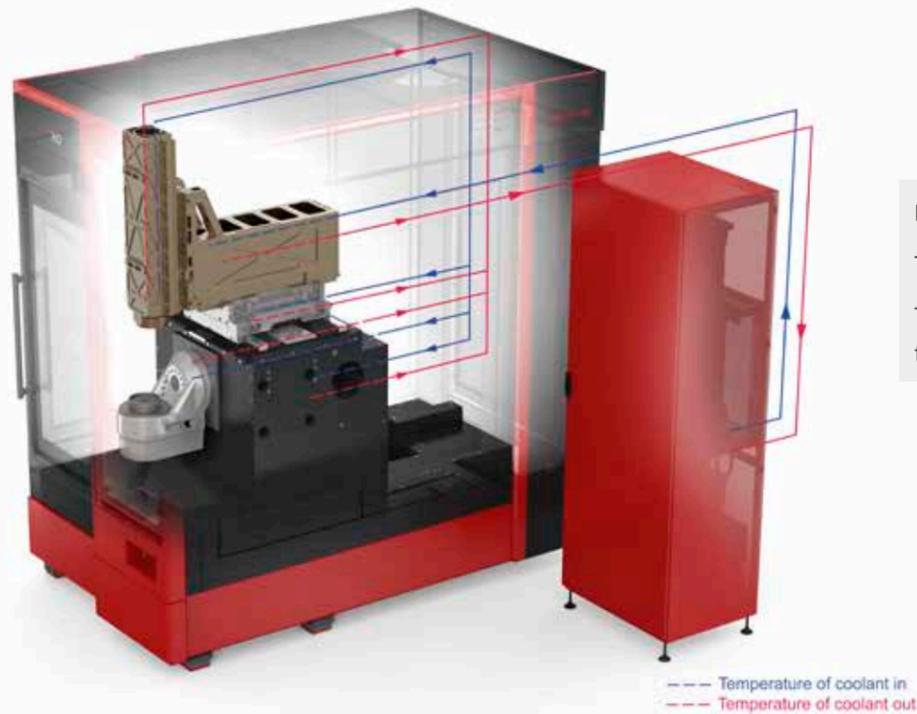
**Circularity test**  
Circular deviation at radius 30 mm,  
Feed F = 1,000 mm / min



## Advanced KERN Temperature Management

Already many years ago KERN announced the fight against the negative influence of temperature deviations in the accuracy system of a machine tool. Great efforts have been made to develop methods that eliminate these effects. In the KERN Micro HD the KERN temperature management system of the next generation is implemented.

This new system generates significantly higher flow rates and an even more precise control, both lead to the greatest possible stability. This stability allows unsurpassed repeatability of parts and the greatest possible independence from external influences.



Flow: 160 - 200 l/min  
 Temperature: 20 °C ± 0,05 K  
 Temperature difference flow/return flow: < 0,5 K

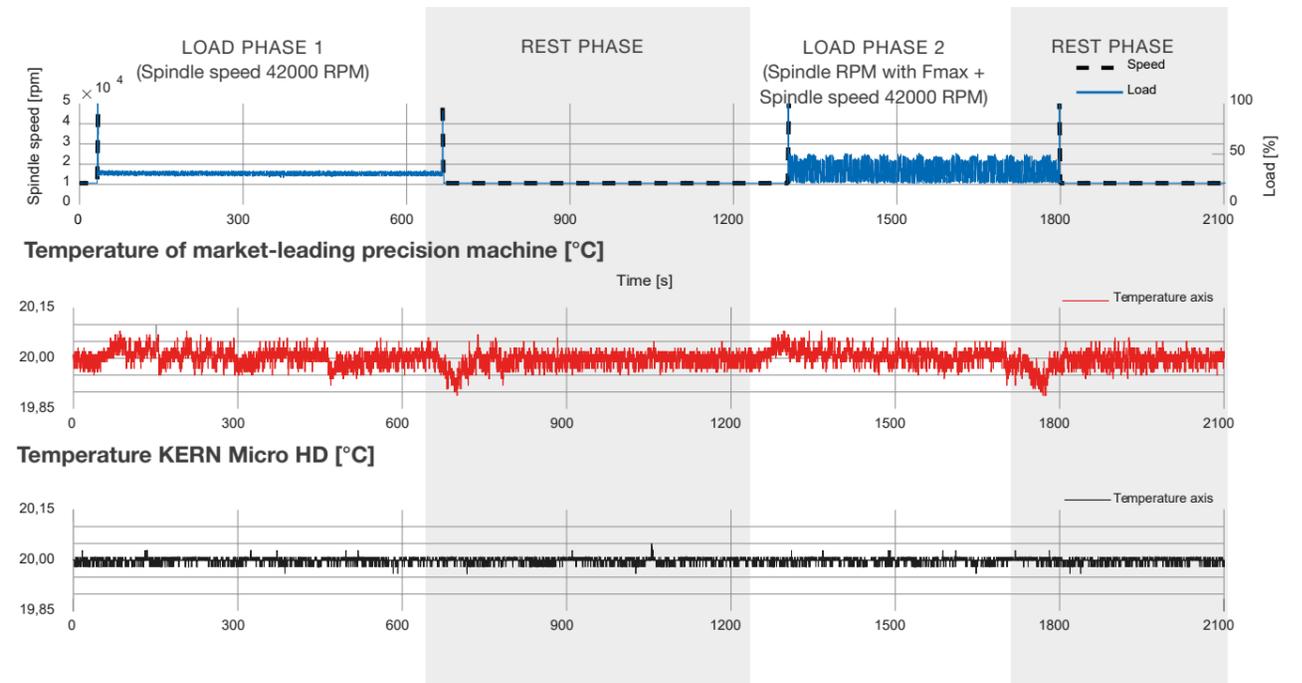
### Temperature management

All components necessary for the accuracy of the KERN Micro HD are being actively kept on temperature

### ACTIVE TEMPERATURE MANAGEMENT OF

- **Machine base**
- **Coolants**
  - Cooling lubricants
  - Liquids of hydrostatics
- **Control Cabinet**
- **Spindle**
- **Rotary and swivel axes**
  - Direct drive
  - Bearings and rotor
- **Linear axes**
  - Direct drive
  - Heat conduction barrier
  - Secondary part
  - Structure

## Stress test Temperature Management



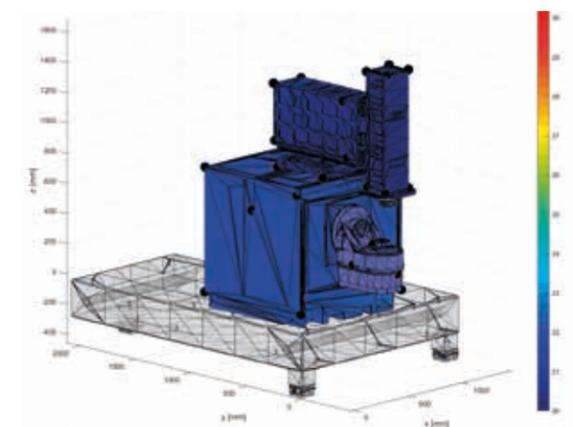
**Temperature management:** Stress test with toughest conditions for the stability of temperature of the machine - the new temperature management of the KERN Micro HD delivers convincing results

## Four-stage axes temperature control

A very important factor for achieving the perfect workpiece geometries is the mastering of temperature influences on a machine tool. This is especially true when working with 5-axis. KERN compensates this challenge with a four-stage temperature control in the linear axes of the KERN Micro HD.

In the first stage, a large part of the heat is already dissipated directly at the source, at the motor windings of the linear motors. In the second stage, the heat of the secondary parts is dissipated. The third stage prevents heat transfer into the structure of the machine. In the fourth stage, the structure itself is tempered, which makes the machine very robust against the effects of heat from the workshop environment. All four levels of temperature control are supplied by the second-generation KERN advanced temperature management system.

With the combination of the extended second-generation KERN temperature management and the four-stage axes cooling a new thermal stability is generated. With this thermal stability tolerances in the low single-digit micrometer range as well as highest surface qualities can easily be achieved.



### Cooling Concept

The test in the climatic chamber shows the performance of the KERN temperature management via colour graduation



**SMALL AND POWERFUL**

Compact and powerful because of the smart one-box design. All accessories are integrated in the machine and the hybrid unit. With a footprint of less than 5 m<sup>2</sup> (54 sqft), an optimized height of only 2.63 m (8.8 ft) and a narrow width of only 1.63 m (5.42 ft). The weight with hybrid unit is less than 6 t (13228 lbs).



**PERFECTLY INTEGRATED**

Additional components such as a flood cooling unit can be integrated into the machine without requiring additional space. Also, the connection of the optional belt filter system and the chip conveyor has been optimized to save space.

**SOLID BASIS**

Innovative machine stand made of UHPC (Ultra High Performance Concrete). No disruptive interfaces, thermo-symmetrically constructed, made from a single casting and equipped with unique material properties.



**100% AUTOMATION**

An effective automation solution is often the key to cost-effectiveness. The integrated tool cabinet for up to 210 tools and a maximum of 60 workpieces allows unattended operation without additional space requirements. Whether external or internal workpiece changer, the KERN Micro HD is perfectly prepared.



**UNMATCHED IN THE 5TH DIMENSION**

Powerful and highly dynamic rotary / swivel axis with torque motors for simultaneous 5-axis machining, market-tested and continuously optimized. Perfect use of available working space and thus it is possible to work on larger workpieces - smart design and best possible arrangement of the 5 axes offer more space.



**INTEGRATED CONTROL PANEL**

There is no better way to integrate an ergonomic control panel into a machine to save space. When not in use, the control panel can be folded down and swiveled back to align straight with the machine and does not require additional space in front of the machine. Completely swung out, it offers the same ergonomics as a control panel supported by an extendable supporting arm, no compromise necessary.

**MAINTENANCE AND PRODUCTION – ALL AT THE SAME TIME**

The well-arranged and fully accessible maintenance area on the side of the machine allows checks and re-filling of lubricants without machine downtime. In addition, necessary maintenance work can be recognized at a glance.



**HYBRID UNIT**

Best machining quality and most flexibility for the footprint. The hybrid unit of the Micro HD includes the optimized KERN temperature management as well as the hydraulic devices and effectively separates vibration sources from the machine stand. If needed, the hybrid unit can be positioned in different places around the machine.



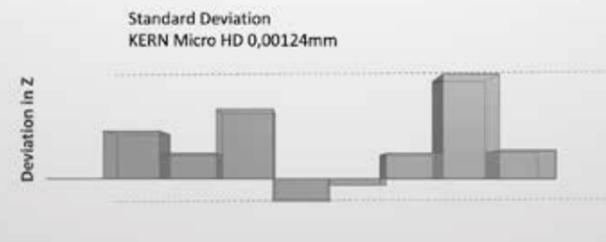
### Multi-Feature Benchmark

Our benchmark part demands sophisticated machining and shows what a machine can do without adjustments and corrections on the first part. This part provides the solutions for almost all the requirements from different industries brought to us over the past years.

#### CHESS BOARD

Machining of 9 surfaces with an identical Z-dimension, each surface being machined with different angular position of the B/C axis.

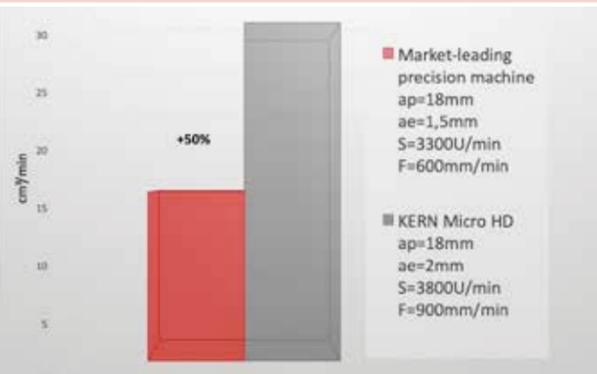
Visualizing the thermal stability of the axle system and the optimal position of the kinematics point.



#### CUTTING CAPACITY

Cutting stainless steel 4305 with a 10 mm HPC cutter using HSC and HPC milling strategies.

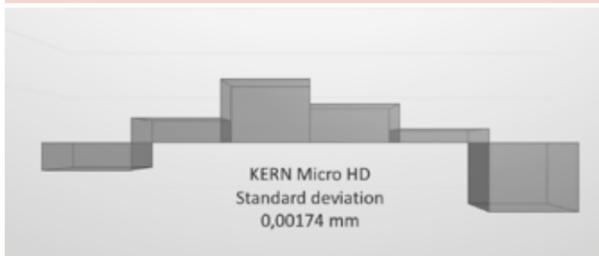
Displaying the high cutting capabilities of a high-precision milling machine with micro-gap hydrostatics in comparison to a market-leading precision machine.



#### TRUTH OF DIMENSION ON 5 - AXES

Highly dynamic machining of pockets and holes, simultaneously with 3-axis as well as 5-axis, for the production of high-precision seal seats.

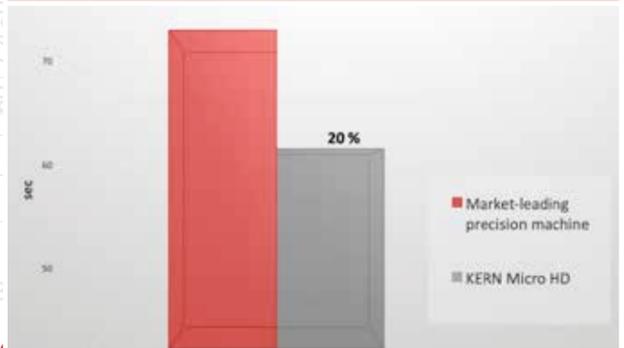
Showing the truth of dimension in X/Y/Z using the same features in different positions with repeated iteration.



#### HIGH SPEED CUTTING

Dynamic trochoidal milling of a notch with a 4 mm end mill and an 11 mm through-hole.

Demonstration of the productivity of dynamic trochoidal milling with a motion of only 1% of the cutter diameter.



#### STEP TEST

Machined step geometry using different tool types and geometries as well as a variation in parameters.

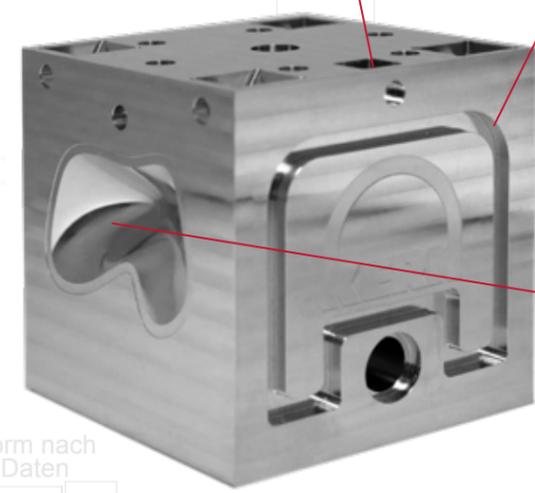
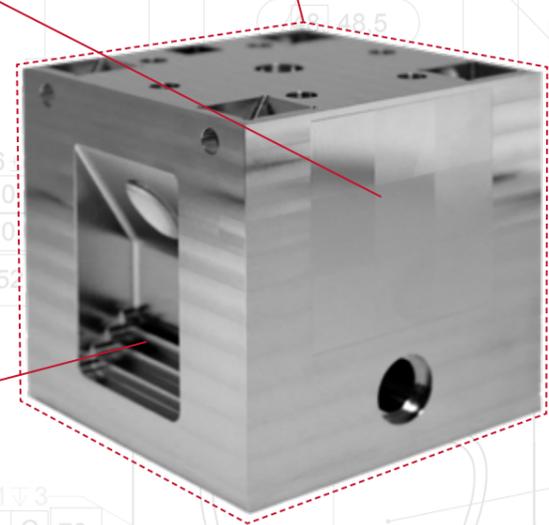
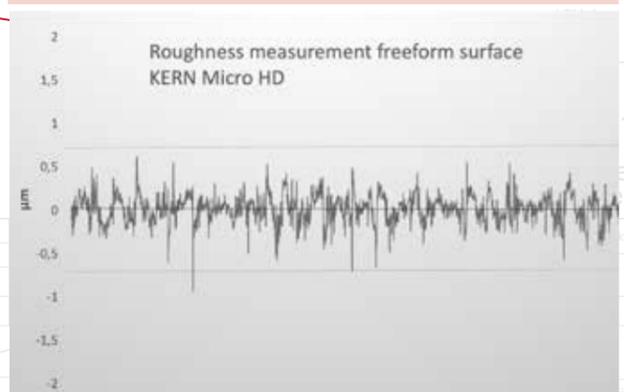
Truth of geometry despite the use of different parameters such as RPM, cutter shape and diameter.



#### FREEFORM SURFACE

3-axis machining of a freeform surface with a 4 mm ball-nose mill.

Optical display of reversing tips and smoothness with the milled freeform surface and the circumferential sealing surface.



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**COOLANT THROUGH SPINDLE**

Optional rotary union to cool tools internally with water-based coolant or cutting oil in combination with belt filter.

Pressure: Cooling lubricant 80 bar / compressed air 6 bar.



Source: Walter AG

**POWER PACK**

To optimize the overall energy consumption as well as to increase the productivity and to ensure maximum availability of the machine.

**BAND FILTER AND CHIP CONVEYOR**

Integrated chip conveyor with ejection to the rear. Connected to the external belt filter system, optionally with high pressure for ICS. Tank capacity: 490 l (108 gallons).

**WORKPIECE CHANGER**

Integrated workpiece changer for up to 60 work pieces allow unmanned operation without additional space requirements. The KERN Micro HD runs fully automated via internal, external workpiece changers or hybrid variants.

**JIG GRINDING PACKAGE**

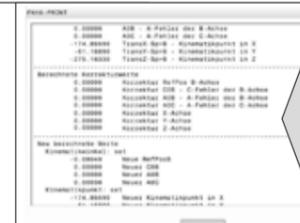
Fully integrated jig grinding package with dressing spindle, fluid and acoustic emission sensor. Heidenhain jig grinding cycles integrated user-friendly into the machine control.

**BDE INTERFACE**

Individual monitoring of machine and operating data for control and evaluation in the customer's own system (Industry 4.0).

**ENLARGED SWIVEL RANGE**

Extension of the swivel range of the B axis. Easy cleaning of workpieces, especially in automated operation.  
Swivel range:  $-180^\circ / +110^\circ$  (standard  $\pm 110^\circ$ ).

**INNOVATIVE CALIBRATION PACK**

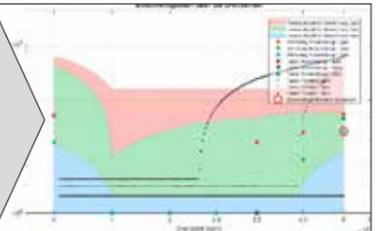
Automatic checking, verification and fine adjustment of the kinematics directly on the machine by the customer.

**DYNAMIC COLLISION MONITORING (DCM)**

Software for real-time collision monitoring of the workspace components (rotary and swivel table, laser, clamping device, spindle and tool holder) in manual and automatic operation.

**PRODUCTIVITY PACKAGE 2**

Individual compensation of all heat-introducing components of the machine for highest accuracy and productivity without additional warm-up times.

**REMOTE SERVICE**

Remote diagnostic with online access for a fast analysis by the KERN service department and process optimization of the KERN Micro HD through KERN application engineers.

**BLUM LASER LC 50**

Laser measuring system with DIGILOG technology. For tool presetting as well as breakage and wear control. Also suitable for smallest tool diameters. Including calibration mandrel with tool holder.

### Linear axes

Travel X/Y/Z: 350/220/250 mm  
 Max. clamping surface: Ø 350 x 200 mm  
 Max. workpiece weight: 50 kg (110,23 lbs)  
 Feed rate: 60 m/min (2,362 in/min)  
 Acceleration: up to 20 m/s<sup>2</sup>

### Rotary and swivel axes

Rotary axis: 360° infinite / 200 rpm  
 Swivel axis: 220° (opt. 280°) / 100 rpm  
 Clamping swivel axis: 300 Nm

### Spindle options

HSK 25-E: 50.000 rpm 6 kW (S1) Roller bearing  
 HSK 25-E: 80.000 rpm 5,5 kW (S1) Air bearing  
 HSK 32-E: 40.000 rpm 6,3 kW (S1) Roller bearing  
 HSK 40-E: 42.000 rpm 15 kW (S1) Roller bearing

### Workpiece size

Height up to 200 mm (7.88 in)  
 Diameter up to 350 mm (13.78 in)

### Accuracies (VDI/DGQ 3441)

Positioning accuracy P: < 1 µm  
 Repeatability Ps: < 0,5 µm

### Accuracies (ISO 230-4)

Circular deviation Gy<sub>x</sub>: ≤ 1 µm  
 Circular deviation G<sub>xy</sub>: ≤ 1 µm

### Tool changer

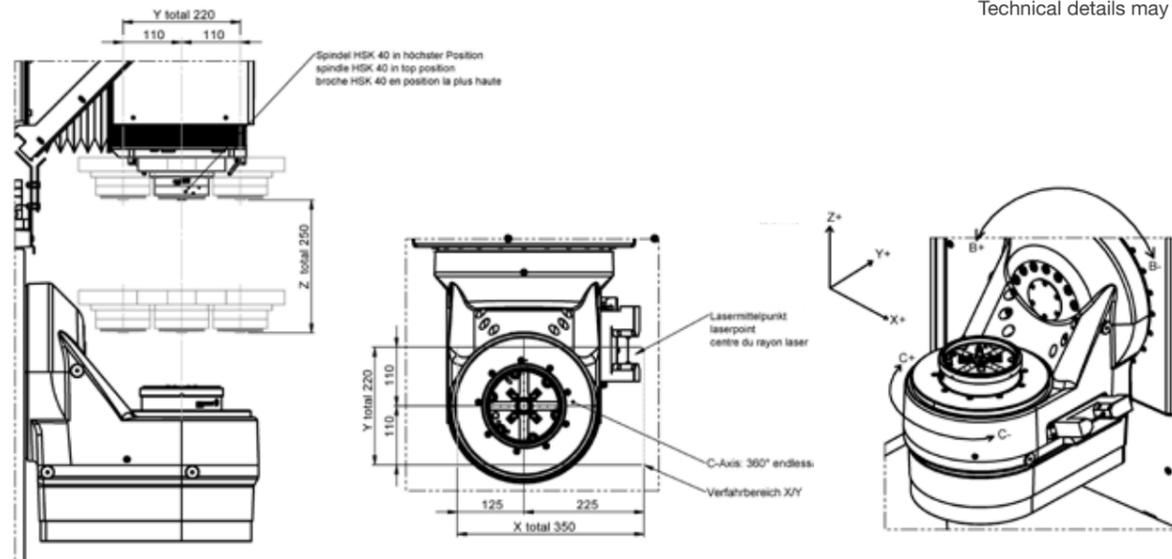
HSK 40: 18-, 102- and 210-pockets  
 Max. tool diameter: 70 mm (2.76 in)  
 Max. tool length: 155 mm (6.10 in)  
 Optional: Combination of tool and workpiece changer

### Technology

Internal temperature management with ± 50 mK control accuracy  
 5-axis simultaneous machining  
 Heidenhain control TNC 640  
 Ultra-compact one-box design  
 Integral design of micro-gap hydrostatics and linear direct drives

### Dimension and Weight

Weight: 5,500 kg (12,125.42 lbs)  
 + hybrid unit 400 kg (881.85 lbs)  
 Min. space required W / D / H: 1.63 x 2.66 x 2.63 m  
 (4.92 x 8.73 x 8.63 ft)



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 Technical details may change





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