KERN FORTIS HD

More than a machine

Left view

Right view

Kern Microtechnik

CONTENT

Kern Microtechnik

WHO WE ARE

Kern Microtechnik GmbH is headquartered in Upper Bavaria in southern Germany. Located in the foothills of the Alps, we have been developing and manufacturing high-precision machining solutions for our customers around the globe for decades. With a focus on innovation, technology and close cooperation with our customers, we help them tackle the challenges of tomorrow. These include the energy transition, medical technology, the semiconductor industry and sustainable manufacturing. As part of AMETEK, we combine the agility and innovative strength of a technology company with the stability and global network of a leading international industrial group. Innovation, the courage to embrace change, and—above all—our dedicated team are the foundation of Kern‘s success and resilience.

„One proof of our strong focus on technology is that we have as many people working in R&D as we have in our assembly.“

Matthias Fritz | DVP Research/Development

What sets Kern apart

In a constantly changing industrial environment, a machine must be adaptable. That‘s why we offer a wide range of machining capabilities and a variety of options, allowing each machine to be configured for its specific application. Kern machines are designed with the future in mind and can be expanded or upgraded at any time.

Our commitment to ethics and sustainability is reflected not only in the way we do business, but also in how we develop our machines. We believe in honest, straightforward relationships with our customers, suppliers and partners. For us, sustainability means taking responsibility for both people and the environment. One example is our regional supply chain: 85% of our suppliers are located within 350 km (220 miles) of our headquarters. We source components from trusted partners, including suppliers in Germany, Austria, and Switzerland.

Wherever tomorrow’s technologies are being developed, quality, precision, and productivity matter today.

Through our work and our machines, we help shape the products and technologies of tomorrow — and contribute to progress across industries. That’s what drives us.
We’re proud of the machines, innovations, and technology we develop, but we know that even the most accurate machine alone does not guarantee outstanding parts. Every application requires a stable, optimized process and the right expertise to achieve its full potential. That’s why Kern offers more than highly precise, highly productive machine tools.
We share our expertise, support our customers in developing new products and technologies, and help them build successful, efficient processes for the long term.

„We strive to exceed our customers‘ expectations and build long-term partnerships.“

Franz Guglhör | Head of Global Service

Distinctive Partnership With Customers

Sales

Our sales team listens closely and develops a deep understanding of our customers’ requirements. Innovation is often driven by customer needs. We look beyond the machine itself and consider the entire manufacturing process to provide comprehensive solutions and address challenges as quickly and effectively as possible.

Applications

Our applications engineering team is equipped with state-of-the-art technology and staffed by experienced, highly motivated experts. It is not a showroom or a laboratory — it is where real parts and real production requirements are used to develop robust, stable processes under real-world conditions. Customers gain a realistic, firsthand understanding of the machine’s capabilities using their own parts and applications. Together, Kern and its customers explore what is possible - and then push those limits further. This is only possible by combining Kern’s comprehensive expertise with the customer’s in-depth knowledge of their application and process.

Kern Training Center

The Kern Training Center provides thorough operator training. Courses show users how to get the most from the machine and the Heidenhain control. The program includes standard Heidenhain courses as well as specialized training in ceramics, deep-hole machining, carbide machining, and more. We also support customers with application-specific process development, maintenance, and service to accelerate the learning curve and keep machines operating efficiently.

Kern Service

Kern Service provides fast, personalized support. Whether you’re dealing with a machine issue, an error message, or a technical question, our service experts respond quickly and work with you to find the right solution. Remote support is also available to resolve issues as quickly as possible. With service technicians located nearby and backed by extensive expertise, we help keep your machines running reliably and performing at their best.

„We are proud of our team and our machine technology. One indication that we’re on the right track is that there are virtually no used Kern Micro machines on the market—and no customers who are not achieving profitable results with their Kern Micro.“

Simon Eickholt | DVP Business Manager

„I’m grateful to be part of this great team of inventors, pioneers, and honest, genuine people who make up the Kern family.“

Sebastian Guggenmos | DVP Operations

Powerful. Precise. Wear-free.

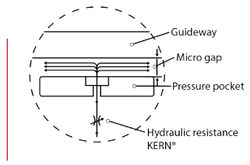
KERN MICROGAP HYDROSTATIC

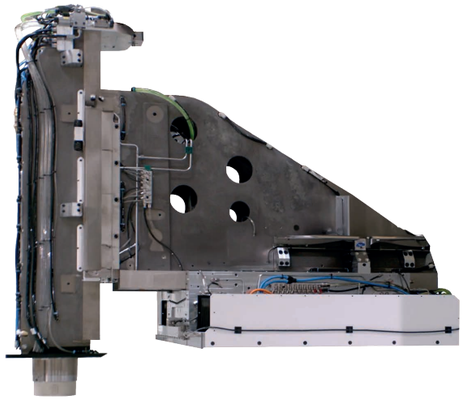
The Kern Fortis HD is designed to be the most accurate 5-axes machine for reliable high-precision machining in serial production. Parts to be machined range from small to very large, the high productivity as well as the strong performance in preceding rough machining make this machine a real asset for high-accuracy machining.

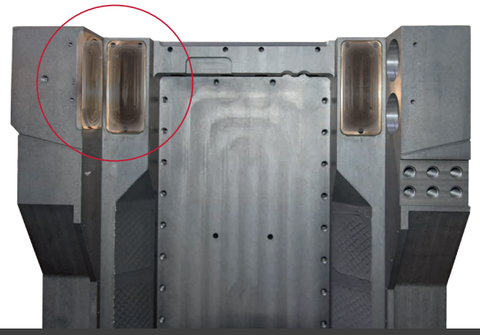
The heart of the system is the microgap hydrostatic in the three-axes structure, which has already proven itself in the Kern Micro HD. Following Kern's development philosophy, this technology has not simply been scaled up, but has been taken up to a whole new level with many new innovations.

The technology of the Kern Fortis HD succeeds in combining:

+ *Stiffness* with high dynamics at the same time
+ *Temperature stability* and accuracy on the workpiece
+ *Wear-free* and reliable highest quality







Hydrostatic
All linear axes of the Kern Fortis HD are equipped with Kern microgap hydrostatic.

„By transferring the 'microgap hydrostatic' technology from the Micro HD to the Fortis HD, the linear axes system of the Fortis HD can also be operated with exceptionally low energy consumption."

Christian Maier | Project Manager Kern Micro HD and Fortis HD

Light. Strong. No compromise.

TOPOLOGY-OPTIMIZED ALUMINUM AXES

The Kern Fortis HD relies on a three-axes aluminum structure – for good reason: because it offers the perfect balance of weight, stiffness and thermal behavior – and thus creates the basis for highly dynamic, precise and durable axes.

Material and structure - aluminum is the key

+ *Durable and resilient* – interface-reduced structural body made of coated high-performance aluminum
+ *Thermal benefit* – adaptive thermal behavior and therefore easy to control
+ *Lightweight and dynamic* - twice as light as steel but has the same stiffness because of a designed functionality in lightweight construction

Advantage: Highest accuracy with a short warm-up time during entire lifetime of the machine.

Aluminum axes:
The aluminum Y-axis is a part of the three-axes structure of the Kern Fortis HD.

Efficient. Compact. Direct.

DRIVE TECHNOLOGY

Together with the thermal design of the Kern Fortis HD, the innovative linear motors are among the most durable and powerful drives for axes. The drive technology of the Kern Fortis HD sets new standards and convinces with its features:

+ *Fast:* direct drive system for highly dynamic accelerations and highest travel speeds
+ *Precise:* high-performance scales, improved control and repeatable mechanic design for highest positioning accuracy and best possible surface quality
+ *Strong:* Upgraded axes cooling system to improve thermal behavior

Linear Direct Drives
The integral design of microgap hydrostatic and linear direct drives provide highest precision and dynamics at the same time.

The combination of technology, material and drive:

Only the combination of microgap hydrostatic and lightweight structural aluminum segments with linear direct drives create the unique, uncompromising synergy in the three-axes structure of the Kern Fortis HD.

Durable. Efficient. Intelligent.

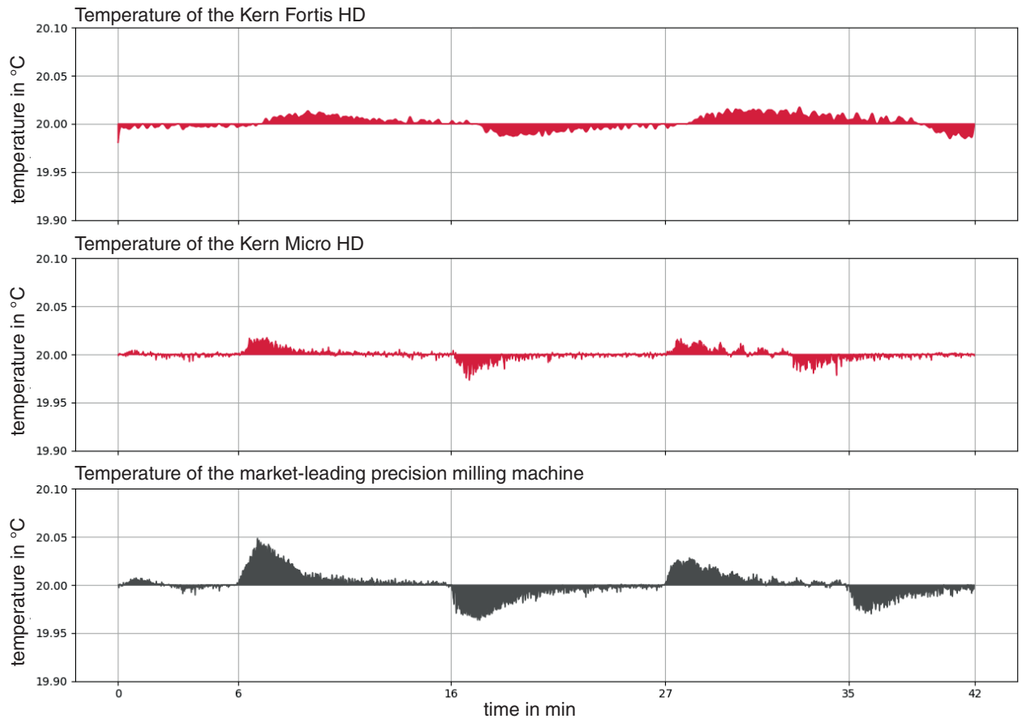
ENHANCED KERN TEMPERATURE MANAGEMENT

Precision begins with temperature, because the main factors influencing the accuracy of the milling machine are thermal effects.*

For this reason, Kern's basis for precision, process reliability and high productivity is a high thermal stability in machine design. The Kern Fortis HD has been designed with an active, multi-level temperature management – for reliable performance even in demanding surroundings.

Advantage: Targeted cooling and permanent monitoring keep the machine in thermal balance – resulting in reliable highest quality, even in challenging surroundings.

Stress test Kern Fortis HD



Temperature management
Enhanced Kern temperature management system in the stress test with most challenging conditions for the temperature stability of the machine.

Systematic cooling

The Kern temperature management of the machine is efficiently supplied with cooling power from external systems such as a central chilled water supply or a chiller. Temperature control is carried out precisely and according to demand via proportional valves – according to the actual needs of the machine during operation. The internal system remains separated from external liquids: the cooling is carried out exclusively by heat exchangers. This reliably avoids temperature fluctuations, thermal shocks and potential contamination – for reliable processes and perfect protection of the machine.

Advantages:

+ Durability in steady operation
+ Best management of temperature
+ Energy-efficient with coolant and for the environment

Advantages, even over long production times and in challenging environment:

+ Shorter or no warm-up times
+ Relaible results
+ Very high 5-axes accuracy
+ Efficient

Cooled elements are:

+ Machine cast
+ Fluids (cooling lubricants & hydrostatic fluid)
+ Three-axes structure (X, Y, Z axis)
+ Axes drives cooled by separate cooling units
+ Cooled spindle housing (bearing outer ring, stator, spindle housing)
+ Shaft cooling (bearing ring, tool interface, rotor, spindle shaft, rotary union)
+ Rotary and swivel unit (direct drive with stator, bearing outer ring)
+ Control cabinet and electronic parts

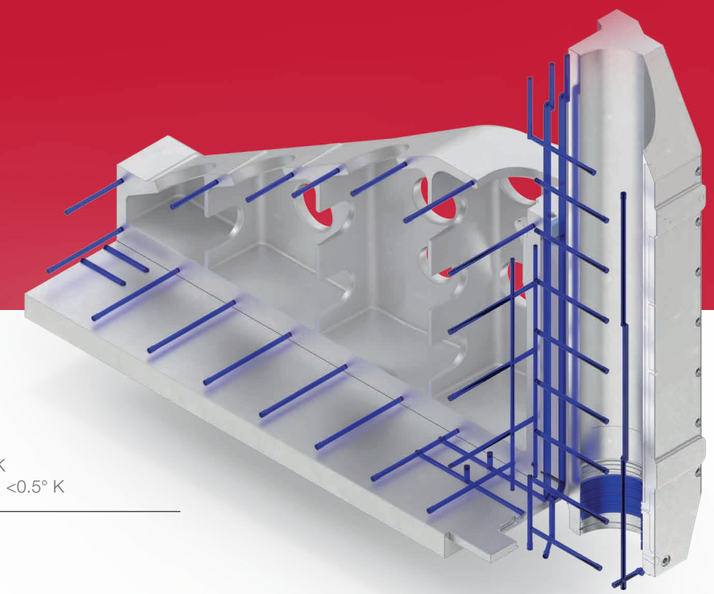
Hybrid Cabinet
The fully integrated hybrid unit which supplies the enhanced Kern temperature management provides the best machining quality – and only requires a small footprint.

ENHANCED KERN TEMPERATURE MANAGEMENT | *Kern Microtechnik*

Advanced four-stage axes cooling

+ *Stage 1:*
  In the first stage, heat is diverted directly at the source, i.e. at the solenoids of the linear motors, *with a separate cooling circuit.*
+ *Stage 2:*
  In the second stage, the heat from the entire magnet unit is diverted.
+ *Stage 3:*
  The third stage prevents heat transfer from the drives to the structural elements of the machine.
+ Stage 4:
  In the fourth stage, the structure itself is cooled, thus eliminating interference from operation.

All four stages of the axes cooling system are supplied by the advanced Kern temperature management, which is in the integrated hybrid cabinet.



Cooled three-axes structure
Temperature: 20°C (68°F) ± 0.05° K
Temperature difference flow/return: <0.5° K

„The Kern Fortis HD remains precise and reliable even under extreme thermal conditions – with the sophisticated heat diversion and active temperature management“

Christoph Staltmeir | Application Engineer

Sturdy. Stable. Determined.

SINGLE-SIDED BEARING-MOUNT

The rotary and swivel unit of the Kern Fortis HD also relies on a single-sided bearing concept. Following one of the basic principles of precision engineering, the proven axis arrangement of the Micro platform was transferred to the dimensions and requirements of the Foris HD – with impressive results.

Advantages of single-sided bearing-mount:

+ *Highest rigidity with smallest footprint:* The arrangement results in high structural rigidity.
+ *Design with thermal benefits:* The single-sided bearing-mount reduces thermal influences on machining accuracy and ensures a thermally stable machine.
+ *High availability and durability:* The bearing is lubricated for life and designed for non-stop industrial operation under high loads.
+ *Scalable precision:* The concept provides high-precision, reliable machining – from very small to very large workpieces.

„The single-sided bearing concept also confirms the advantages of Predictable Design in this new dimension of high-precision mechanical engineering with a high rigidity at the same time.“

Fabian Tripkewitz | Development Engineer

Compact. Flexible. Integrated.

THE TOOL MANAGEMENT SYSTEM

Innovative implementation and proven technology

The tool changer of the Kern Fortis HD is based on the proven Micro platform and adds new, high-performance features. The integrated 2-axes system achieves an exceptionally high tool density on a tiny footprint.

Advantages:

+ Space-saving sliding doors for best accessibility
+ External and internal steps for ergonomic tool access
+ Glass elements in the doors and integrated lighting enable visual inspection while machine is running
+ Compact design with high tool capacity on small footprint
+ Seamless connection of the automatic tool changer to the machine control system

Facts and figures at a glance:

Feature	Specification
Tool holders	HSK-A63 DIN, HSK-E40 DIN
Max. tool length	up to 400 mm
Max. tool weight	HSK-A63: up to 10 kg (22 lbs) HSK-E40: up to 1.5 kg (3.3 lbs)
Capacity	HSK-A63: up to 154 pockets HSK-E40: up to 349 pockets

Clean. Powerful. Effective.

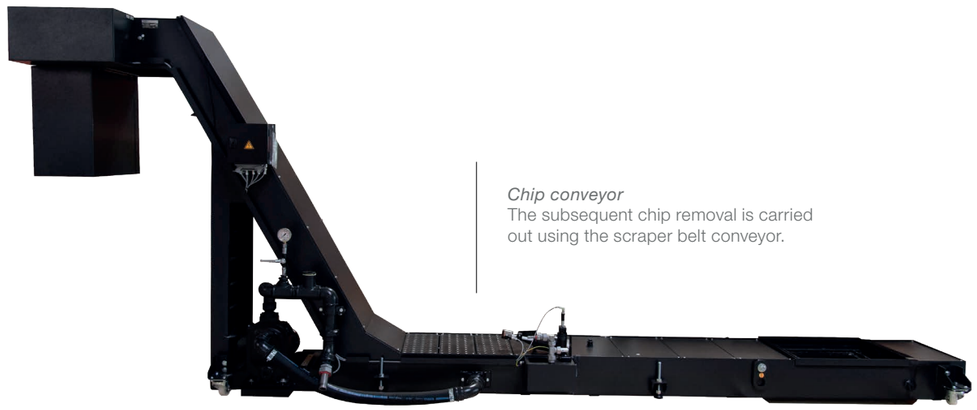
CHIP MANAGEMENT

More than just chip transport

The chip management of the Kern Fortis HD is designed for reliable processes. This starts with the design of the machine bed and workspace in the design process. The aim is not only to remove chips, but above all to avoid chip accumulation in the work area, especially during wet machining and high cutting performance.

With the targeted rinsing cycles with powerful nozzles, the work area is cleaned, which also includes the removal of contamination on the following parts:

+ Tool changer flap
+ Workpiece changer door
+ Machine table
+ Workroom door
+ Bellows of the Z-axis
+ Machine bed



Chip conveyor
The subsequent chip removal is carried out using the scraper belt conveyor.

Lubrication system

Filtration & temperature control for longest tool life:

The cooling lubricant system of the Kern Fortis HD relies on a two-stage filter system with belt filter and optional pot or cartridge filter. The coolant is processed and tempered in a separate pure and purest tank (total volume 1700 l) – for on-going machining and highest precision.

Technology for every application:

+ Coolant through spindle:
  25 l/min (6.6 gallon/min) at max. 80 bar
+ Flood Cooling7:
  50 l/min (13.2 gallon/min) at max. 3 bar
+ Rinsing: 140 l/min (37 gallon/min) at 3 bar
+ Circulation and cooling

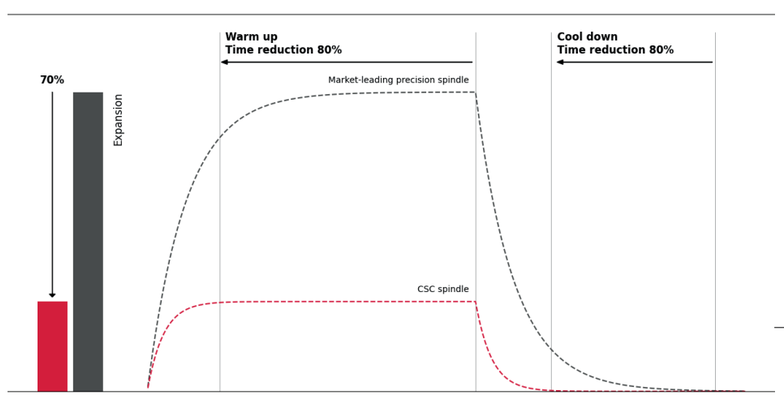
Belt filter
Divided into two tank units, pure tank and purest tank with a volume capacity of 1700 liters (450 gallon).

Compact Shaft Cooling

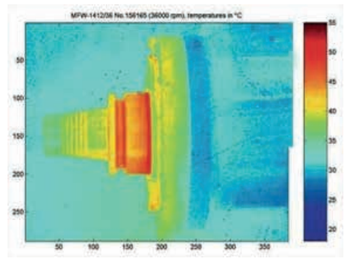
THE SHAFT-COOLED HIGH-SPEED SPINDLE

The new generation of high-frequency spindles are the CSC spindles (Compact Shaft Cooling), which stand out with their shaft cooling, non-contact rotary union and extended speed range. In addition to the well-known temperature control of the stator, the front and rear outer bearing rings and the spindle housing, the shaft cooling of the entire spindle shaft now also cools the rotor of the motor, the bearing's inner rings, the tool interface and the rotary union. With the integration into the advanced Kern temperature management, high thermal stability, low spindle growth and shortest thermal warm-up times are achieved.

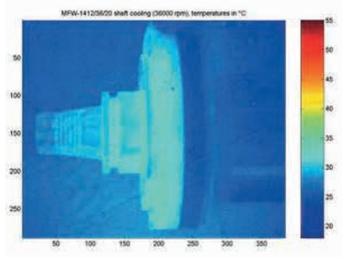
The temperature control system is supplied by an independent unit which is integrated in the machine design. In addition, the non-contact rotary union allows the use of internally cooled tools with compressed air, lubricant and oil without restrictions.



Shaft cooling
Temperature curve with or without shaft cooling



Without shaft cooling



With shaft cooling

Image source: Fischer Spindle AG

Image source: Fischer Spindle AG

Advantages of Compact Shaft Cooling:

+ ***High productivity increase*** through significant reduction of thermal warm-up processes by up to 80%
+ ***Thermal stability*** even at high speeds and long cycle times
+ ***High roughing performance*** (HSK-A63) with powerful torque transmission
+ ***Process reliability*** with temperature regulation of relevant parts
+ ***Sustainable*** with efficient cooling and filtered coolant

Spindelvarianten

HSK interface	**E40**	**A63**
Power (S1/S6) [kW]	15/18,5	29/38
Torque (S1/S6) [Nm]	6/6,5	69,2/90,7
Speed (nominal/max) [1/min]	0-45.000	0 – 24.000

CSC HSK-E40

CSC HSK-A63

„With the active cooling of the spindle shaft, rolling bearing spindles take a big step to close the technological gap towards air bearings in terms of their thermal behavior."

Tim Knobloch | Development Engineer

Our Kern Fortis HD

FEATURES

fully accessible

Efficient control 1

The well-arranged and fully accessible maintenance area on the side of the machine allows checking and filling up of lubricants without machine downtime. In addition, necessary maintenance is clearly visible and can be carried out at a glance.

perfectly prepared

External automation option 2

The Kern Fortis HD is easily compatible with external automation for the best handover of workpieces. The machine is perfectly prepared and can run without an operator on site.

ergonomic work

Two-part access door 3

The access door is consisting of two parts and can be slid open to the left and right. This makes it easier for the operator to load and set up the machine and also provides excellent accessibility and observability.

FEATURES | *Kern Microtechnik*

Our Kern Fortis HD

FEATURES

fully swingable

Heidenhain Control TNC7 4

The control panel can be swiveled flat into the machine at any time and does not require any additional space in front of the machine. When fully extended, it offers the same ergonomics as a support arm control panel, without any compromise.

for easy tool access

Steps 5

The steps outside of the machine and inside of the tool changer allow easy and ergonomic access to the tools in the tool cabinet.

fully Integrated

Hybrid Cabinet 6

Best machining quality with a reasonable footprint are guaranteed by the fully integrated hybrid unit of the Kern Fortis HD. The hybrid cabinet includes the hydraulic supply for hydrostatics of the axes as well as the extended Kern temperature management.

OPTIONS | *Kern Microtechnik*

MORE OPTIONS

Filtration

+ *Band filter:*
  Available with low- or high-pressure systems up to 1,160 PSI (80 bar) for through-tool coolant delivery, with a 449-gallon (1700 L) tank. Band filters are available in different configurations and can be tailored to specific applications.

Cooling, Lubrication, Chip Management

+ *Coolant through spindle:*
  Rotary union for through-tool coolant delivery using air, emulsion, or oil, in combination with a paper band filter. Pressure: coolant 1,160 PSI (80 bar) /compressed air 145 PSI (10 bar).
+ *BEMA nozzles:*
  Coolant nozzles automatically adjust to the individual tool length for best possible cooling.
+ *Chip conveyor:*
  Integrated chip conveyor with discharge at the rear of the machine. Available only in combination with a band filter.
+ *Minimum quantity lubrication:*
  Micro-dosing pumps with dual dosing units and two coaxial nozzle arms with stainless-steel nozzle tips. Oil flow is easily adjusted from the Heidenhain control to match the application. Oil reservoir capacity: 0.4 gal (1,5 L).

Integrated tool management system

+ *3D Tool Comp:*
  Provides powerful 3D tool-radius compensation and allows measurement of 3D tool geometries. Tool compensation tables can be used to define angular delta values that describe deviations from the tool's ideal circular profile. The system can also compensate for the radius at the tool's current contact point with the workpiece.
+ *Form Control X:*
  User-friendly measurement and automation software for automated quality control of parts in both single-part and series production. It helps maximize productivity and minimize scrap by enabling in-process and post-process inspection, measurement-based process control, and rework without removing the part from its original setup.
+ *BLUM Laser LC50 with Digilog function:*
  Digilog technology uses a scanning measurement process with higher sampling rates, reducing measurement and inspection times by up to 60%. It also improves process reliability when chips or coolant build up on the cutting edge.

Automation

+ *Integrated tool changer:*
  Integrated tool changer: Unmanned multi-shift operation thanks to integrated changer for up to 349 tools with HSK E40 interface and 154 tools with HSK A63 interface.
+ *External automation:*
  Easily compatible with external automation for optimal workpiece changeover. The Kern Fortis HD is perfectly prepared and suited for unmanned operation.

Productivity

+ *Kern Advanced Machining:*
  A combination of *Machine Vibration Control (MVC)* and *Cross Talk Compensation (CTC)*. MVC suppresses low-frequency vibrations and enables vibration-free milling at high accelerations. CTC compensates for position-related deviations and allows a significant increase in feed rate. The result: shorter machining times, improved surface quality, higher accuracy, and longer tool life.
+ *Energy Saving Pack:*
  To optimize overall energy consumption and to increase productivity and provide ideal machine availability.
+ *Kern Active Thermal Calibration:*
  Thermal compensation for heat generated by individual machine components helps maintain high accuracy and productivity while significantly reducing warm-up time.

Safety

+ *Collision Monitoring – DCM V2:*
  *S*oftware for real-time monitoring of components within the machining area. Predefined clearance zones are continuously checked against machine movements. If a collision is imminent, machining is automatically stopped.
+ *Fire Suppression:*
  Fire protection system with an adjustable activation temperature from 122°F (50°C) to 302° F (150°C).
+ *Teleservice:*
  Kern Service can remotely access the Heidenhain control and other machine components through the internet and the customer's network, enabling fast diagnostics and troubleshooting.

Information

+ *PDA interface - 3 signals can be selected:*
  The machine provides key operating and status data for digital production monitoring. Operators have a clear view of machine status and can adjust processes as needed to keep production running efficiently.
+ *OPC UA interface:*
  A secure, reliable interface for integrating modern industrial applications. Standardized interfaces simplify integration and allow multiple systems to be connected as needed.
+ *DNC 18:*
  Software function for communication between a cell controller and the Heidenhain control.

At a glance

TECHNICAL DETAILS

Linear axes
Travels X/Y/Z: 780/420/450 mm (30.7/16.5/17.1 in)
Travel speed: 60 m/min
Acceleration: bis 15 m/s²

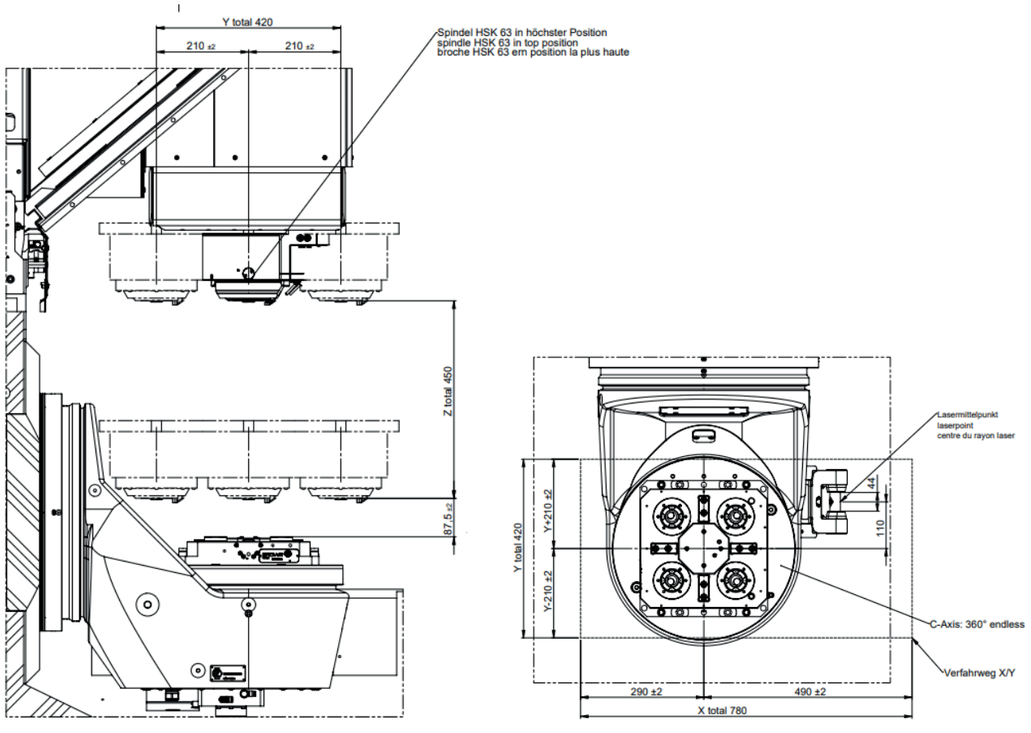
Rotation and swivel axes
Axes: ± 360° endless
Swivel axes: ± 120°

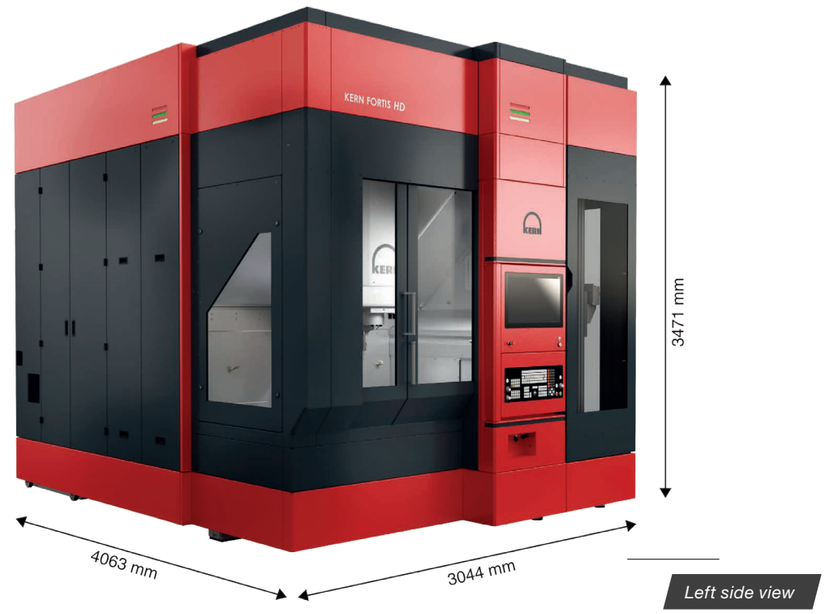
Workpieces
Max. clamping surface: Ø565 x Z350 mm
(Ø565 x Z13.8 in)

Concept
Internal temperature management
with steady temperature +/- 0.05° K
5-axes simultaneous machining
Heidenhain Control TNC7
Ultra-compact one-box design
with integrated hybrid unit
Integral design of micro-gap hydrostatics and linear direct drives

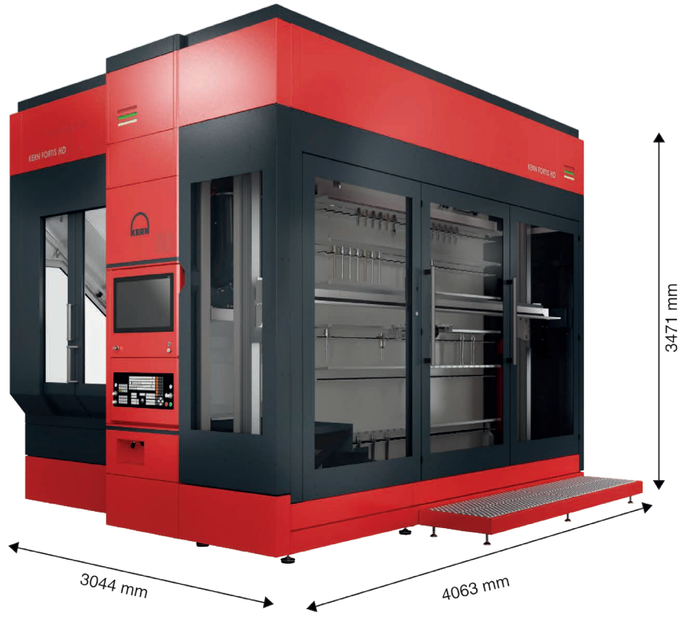
Dimensions and weights
Weight: 15.500 kg (34171.651 lbs)
Dimensions: 4063 x 3044 x 3471 mm
(13.3 x 10 x 11.4 ft)
Minimum space requirements B/T/H:
4860 x 6240 x 3860 mm
(15944,88 x 9986,87 x 12664,04 ft)

Status 09/2025
Subject to technical changes





Left side view



Right side view

**Quelle S. 09:*
Mayr, J., Jedrzejewski, J., Uhlmann, E., Donmez, M.A., Knapp, W., Haertig, F., Wendt, K., Moriwaki, T., Shore, P., Schmitt, R., Brecher, C., Wuerz, T., Wegener, K., 2012. Thermal issues in machine tools. CIRP Annals - Manufacturing Technology, 61(2):771-791.

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