# KERN FORTIS HD

More than a machine


*Left view*

*Right view*



*Kern Microtechnik*

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*Kern Microtechnik*

# WHO WE ARE

Kern Microtechnik GmbH, with its headquarter in Upper Bavaria in Southern Germany, in the unique landscape of the foothills of the Alps, surrounded by high mountains, sparkling rivers and picturesque lakes has achieved a leading position in high-precision technology around the globe over the last decades. With a long-standing focus on technology, innovation and proximity to customers, Kern is an established partner for customers worldwide to realize their ambitious goals in many different industries like medical, aerospace, watchmaking, defense, semiconductors and many others. A common goal is a sustainable cross-generational development. Our innovative strength, our willingness to change and, above all our great team are the secret of our corporate strength and resilience to crises.

“Proof of our strict focus on technology is the fact that we employ as many people in R&D as in our assembly.”

*Matthias Fritz | DVP Research/Development*

## What does Kern do?

Changes in the industrial environment are always taking place. Therefore, our machine must be flexible and adaptable. We offer a wide range of applications and many options to have the best equipped machine for each task. Nothing is as persistent as change, which is why a Kern machine can always be adjusted as needed.
Our commitment to ethics and sustainability cannot only be seen in our business relationships, but also in the way we develop our machines. As a commercial company, honesty and stability are very important for us when dealing with customers, suppliers and partners. For us, sustainability means thinking and acting with the future in mind and how to have a positive influence on society and the environment.

Among other things, we realize this with our supply chain; 85% of our suppliers are within 350 km (220 miles) of our headquarter. We source our parts from reliable partners in Germany, Austria and Switzerland, among others.

**Quality, precision and productivity are the key when shaping our future.**

With our work and our machines, we make a significant contribution to the products of tomorrow, to new technologies and to progress in general. We are proud of this, and this is also what brings us forward.
Kern and its employees are proud of their machines, their innovations and their technologies standing behind their products. However, the most precise machine does not automatically make good parts; this requires the best process for the respective application and the necessary know-how. And this is why Kern offers more than an extremely accurate and productive machine. We share our knowledge with our customers, help develop new products and technologies and ensure the success for our customers

„It is our goal to exceed the expectations of our customers and to build up a long-lasting partnership.“

*Franz Guglhör | Head of Service*





# The close connection to customers

## Sales

The sales team listens carefully and fully understands the needs of customers. Innovations are always adapted to the customers’ needs. Not only the machines, but also the surrounding procedures are considered to provide comprehensive assistance and resolve problems as soon as possible.

## Applications

The applications team has the latest equipment, and the team is very experienced and ambitious. It is not about showrooms or laboratories but about the real integration of customers. Reliable processes are being developed for real parts under real conditions – conditions we find at our customers’ sites. Customers gain real insight into the capabilities of the machine – not with sample parts but with real manufacturing of real parts. Limits and capabilities of the machines are being pushed and Kern provides access to a wide range of expertise to ensure the machine is being used in its entirety.

## Kern Training Center

The Kern Training Center provides valuable know-how for all participants. The training shows how to make the best use of the machines and their Heidenhain control. Classes include for example ceramics, deep hole and carbide training and many more are available. With a wide program from basic classes to maintenance, troubleshooting and individualized applications Kern ensures a steep learning curve and efficient operation of the machine.

## Service

The Kern Service provides fast and individual support. Specialists are available per phone and e-mail to provide solutions for problems. The quality of the available expertise is unmatched. The available teleservice delivers immediate support. Since our technicians are experts in their field and since they are close by it is easy to maintain machines in best shape.

„I am grateful to be a member of this great team of inventors, pioneers and honest people – the Kern family.“

*Simon Eickholt | DVP Business Manager*

„We are proud of our team and machine technology. That we took the right path is proven by the fact that neither used Micro machines are available nor are there customers who are not economically successful with their Kern Micro.”

*Sebastian Guggenmos | DVP Operations*

*Powerful. Precise. Wear-free.*

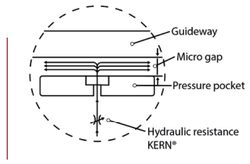
# KERN MICROGAP HYDROSTATIC

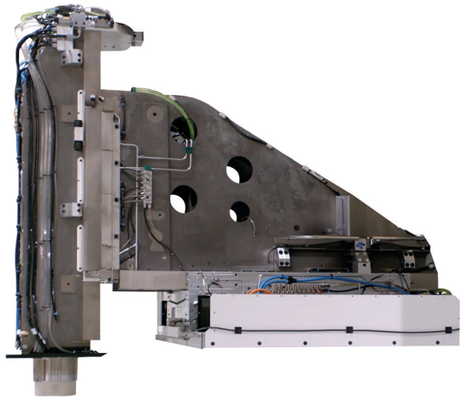
The Kern Fortis HD is designed to be the most accurate 5-axes machine for reliable high-precision machining in serial production. Parts to be machined range from small to very large, the high productivity as well as the strong performance in preceding rough machining make this machine a real asset for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

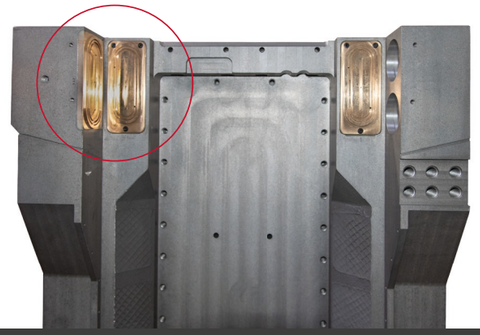
The heart of the system is the microgap hydrostatic in the three-axes structure, which has already proven itself in the Kern Micro HD. Following Kern's development philosophy, this technology has not simply been scaled up, but has been taken up to a whole new level with many new innovations.

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.*

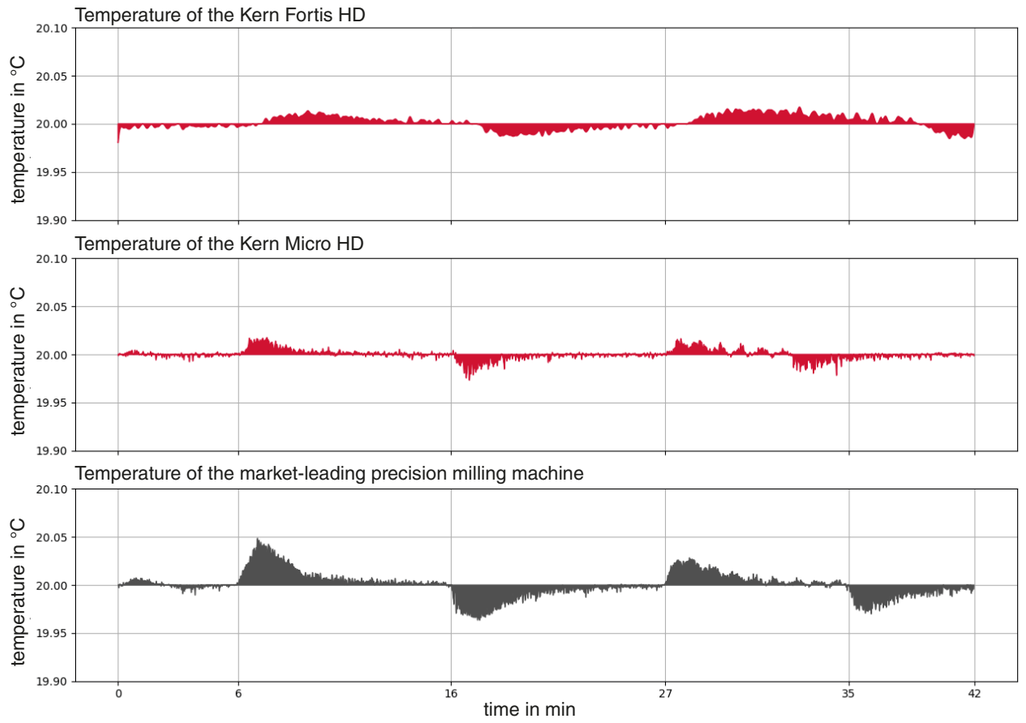
# ENHANCED KERN TEMPERATURE MANAGEMENT

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.

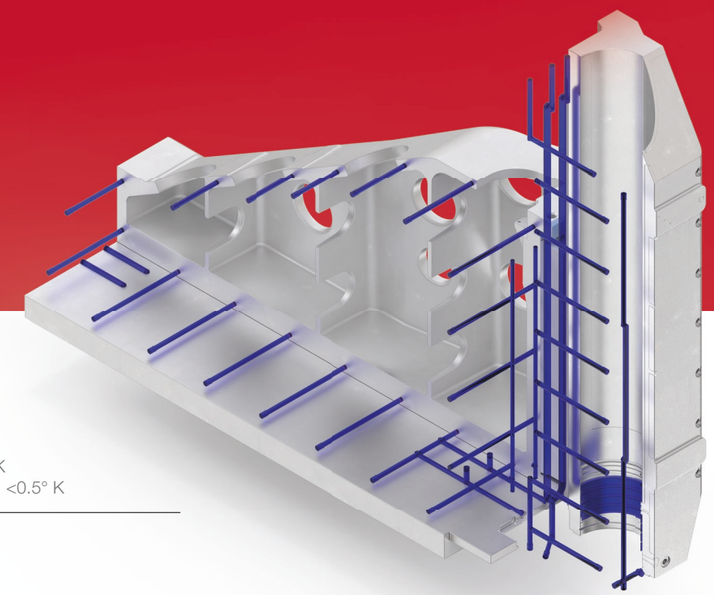


ENHANCED KERN TEMPERATURE MANAGEMENT | *Kern Microtechnik*

# 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 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)<br>HSK-E40: up to 0.5 kg (1.1 lbs) |
| **Capacity** | HSK-A63: up to 154 pockets<br>HSK-E40: up to 349 pockets |





*Clean. Powerful. Effective.*

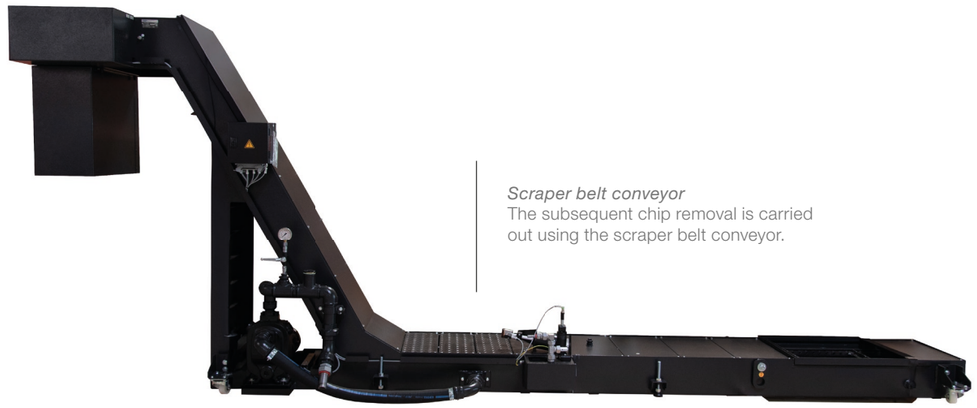
# CHIP MANAGEMENT

## 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



*Scraper belt 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

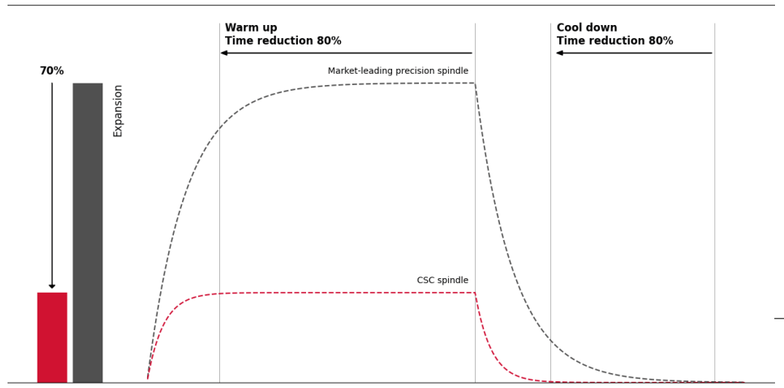
*Belt filter*
Divided into two tank units, pure tank and purest tank with a volume capacity of 1700 liters (450 gallon).

*Compact Shaft Cooling*

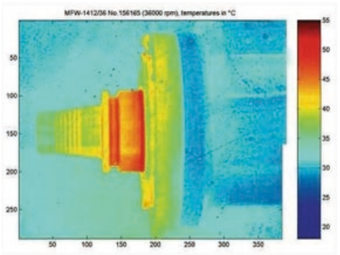
# THE SHAFT-COOLED HIGH-SPEED SPINDLE

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.

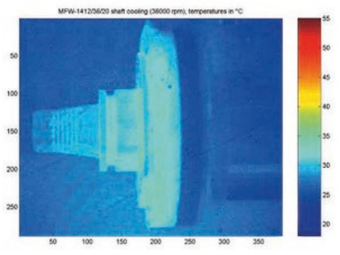



*Shaft cooling*
Temperature curve with or without shaft cooling




*Without shaft cooling*

*Image source:* Fischer Spindle AG




*With shaft cooling*

*Image source:* Fischer Spindle AG



SPINDLE | *Kern Microtechnik*

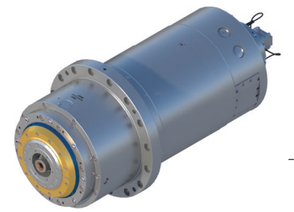
## Advantages of Compact Shaft Cooling:

+ ***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 |

*HSK E40*



*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.





*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*

# Options

## Filtration

+ *Band filter in different stages of expansion:*
  Options are with high pressure up to 80 bar for internal coolant supply and 1700 l (449 gallon) tank capacity. The system is also available in different levels to suit different machining processes; also, with different filter options for certain applications.

## Cooling, Lubrication, Chip Management

+ *Coolant through spindle:*
  Optional rotary union for the use of internal cooled tools with air, emulsion or oil in combination with bandfilter. Pressure: Cooling lubrication 80 bar / compressed air 10 bar.
+ *BEMA nozzles:*
  The automatic coolant nozzles adjust individually and precisely to the respective tool length. As a result, the cooling medium arrives where it is needed and ensures optimal cooling and flushing.
+ *Scraper belt conveyor:*
  Integrated chip conveyor with ejection at the right side of the machine. Only available in combination with a band filter.
+ *Minimum quantity lubrication:*
  Micro dosing pumps with double dosing device and two coaxial nozzle arms with stainless steel nozzles. For each application the amount of oil can be adjusted with a specific function. Oil reservoir is 1.5 l (0.4 gallon).

## Integrated tool management system

+ *3D Tool Comp:*
  Provides a powerful, three-dimensional tool radius correction, as well as the measurement of 3D geometries. For this purpose, angle-dependent offset values can be defined via correction value tables, which describe the deviation of the tool from the ideal circular shape. In addition, it is possible to compensate for the radius value defined at the current contact point of the tool with the workpiece.
+ *Form Control X:*
  User-friendly measurement and automation software for automated quality control of workpieces coming out of prototype or serial production. The system provides extremely high productivity as well as minimal scrap because of control measurements between and after machining, static process control based on the recorded measured values and re-machining parts if needed in the original clamping.
+ *BLUM Laser LC50 with Digilog function:*
  The Digilog technology works with a scanning process and higher sampling rates. This results in up to 60% percent shorter measurement and testing times and an increased process reliability in the event of contamination and coolant adhesion on the tool's 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

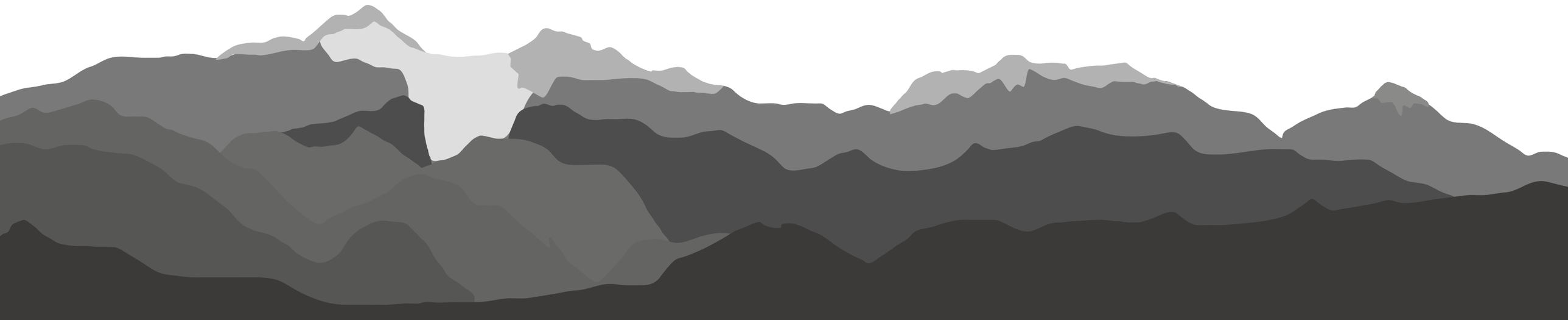
+ *Kern Advanced Machining:*
  A combination of *Machine Vibration Control (MVC)* and *Cross Talk Compensation (CTC)*. MVC suppresses low-frequency vibrations and enables vibration-free milling at high accelerations. CTC compensates for position-related deviations and allows a significant increase in 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.
+ *Productivity Pack 2:*
  Individual compensation of all heat-dissipating parts of the machine for highest accuracy and productivity without any additional warm-up time.

## Safety

+ *Collision Monitoring – DCM V2:*
  Software for permanent monitoring of workspace components. Endangered envelopes of predefined components are compared in real time with machine movements. In the event of a possible collision, machining is interrupted.
+ *Fire extinguishing system:*
  Safety function in case of fire made of die-cast aluminum with adjustable trigger temperature between 50°C and 150°C (120° F and 300° F).
+ *Teleservice:*
  Kern Service Team has remote diagnostic access to the Heidenhain control and other parts of the machine via Internet and customer network to perform rapid analyses and process optimization.

## Information

+ *PDA interface - 3 signals can be selected:*
  Software for permanent collision monitoring of the components in the work area (rotary and swivel table, laser, clamping device, spindle and tool holders) in manual and automatic operation.
+ *UPC UA interface:*
  Secure and stable interface for connecting modern industrial applications. Easy to use since standardized concepts are being used and it is possible to combine different interfaces.
+ *DNC 18:*
  Software function that enables a higher-level cell computer to communicate with 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

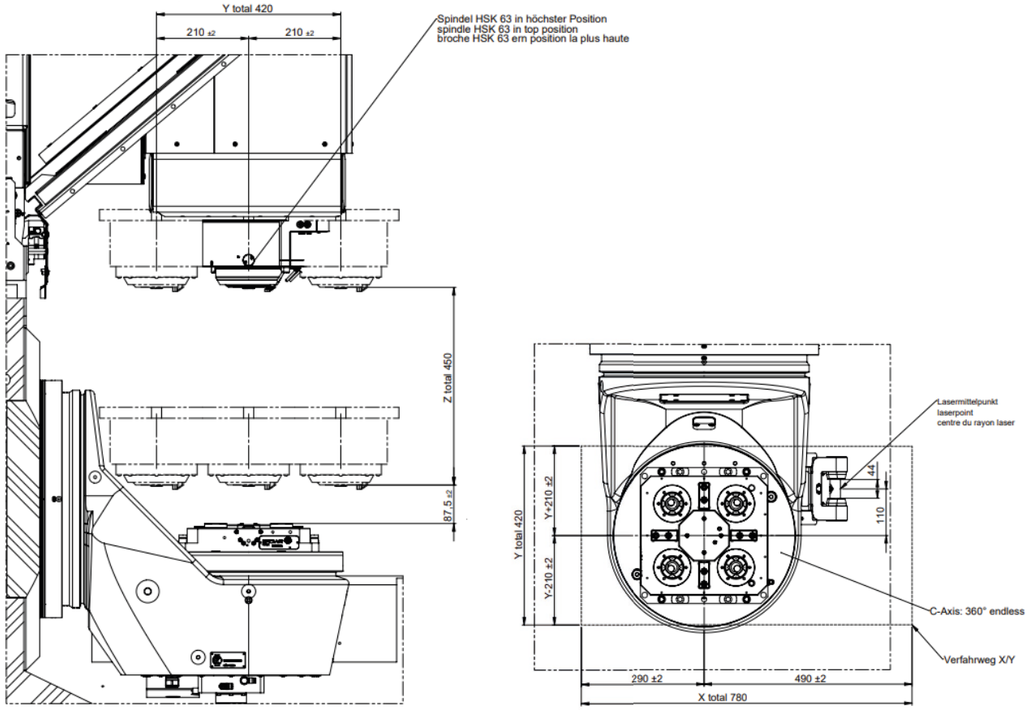
## Rotation and swivel axes
***Axes***: ± 360° endless
***Swivel axes***: ± 120°

## 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

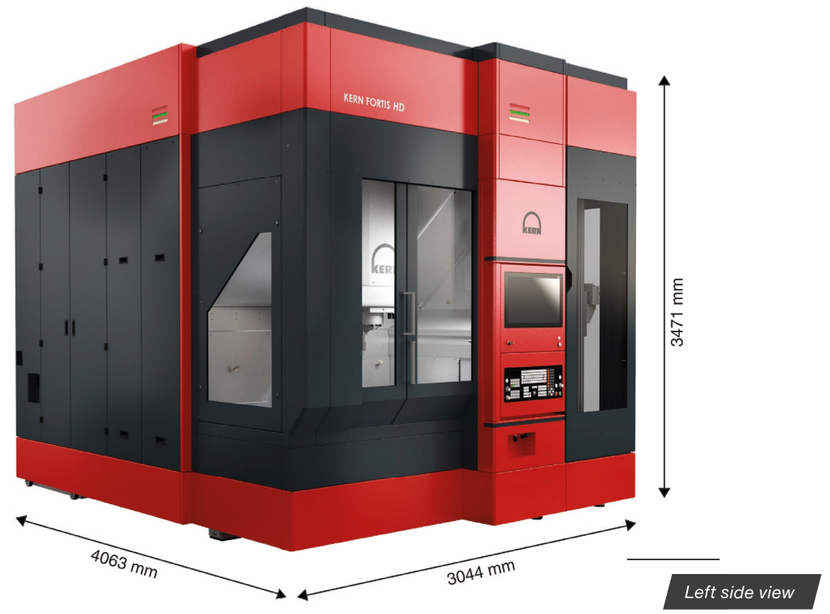
## Dimensions and weights
***Weight***: 15.500 kg (34171.651 lbs)
***Dimensions:*** 4063 x 3044 x 3471 mm
(13.3 x 10 x 11.4 ft)
***Minimum space requirements*** B/T/H:
4860 x 6240 x 3860 mm
(15944,88 x 9986,87 x 12664,04 ft)

*Status 09/2025*
*Subject to technical changes*

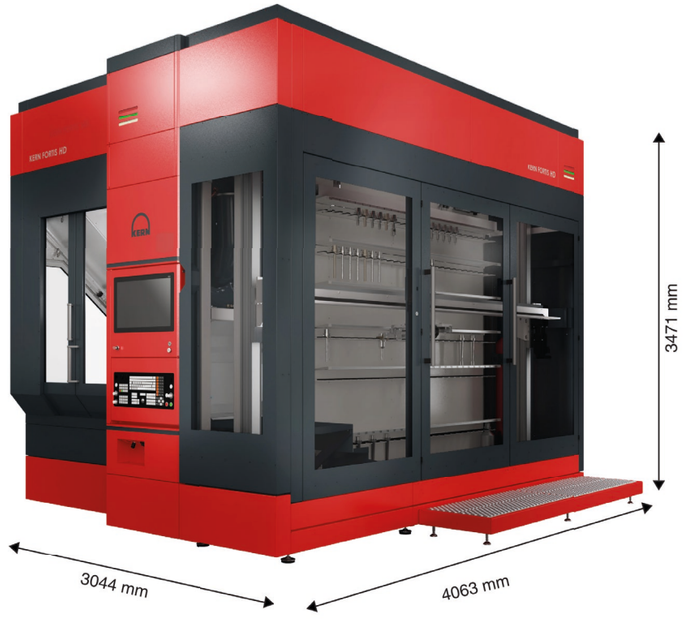







*Left side view*




*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.


KERN
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