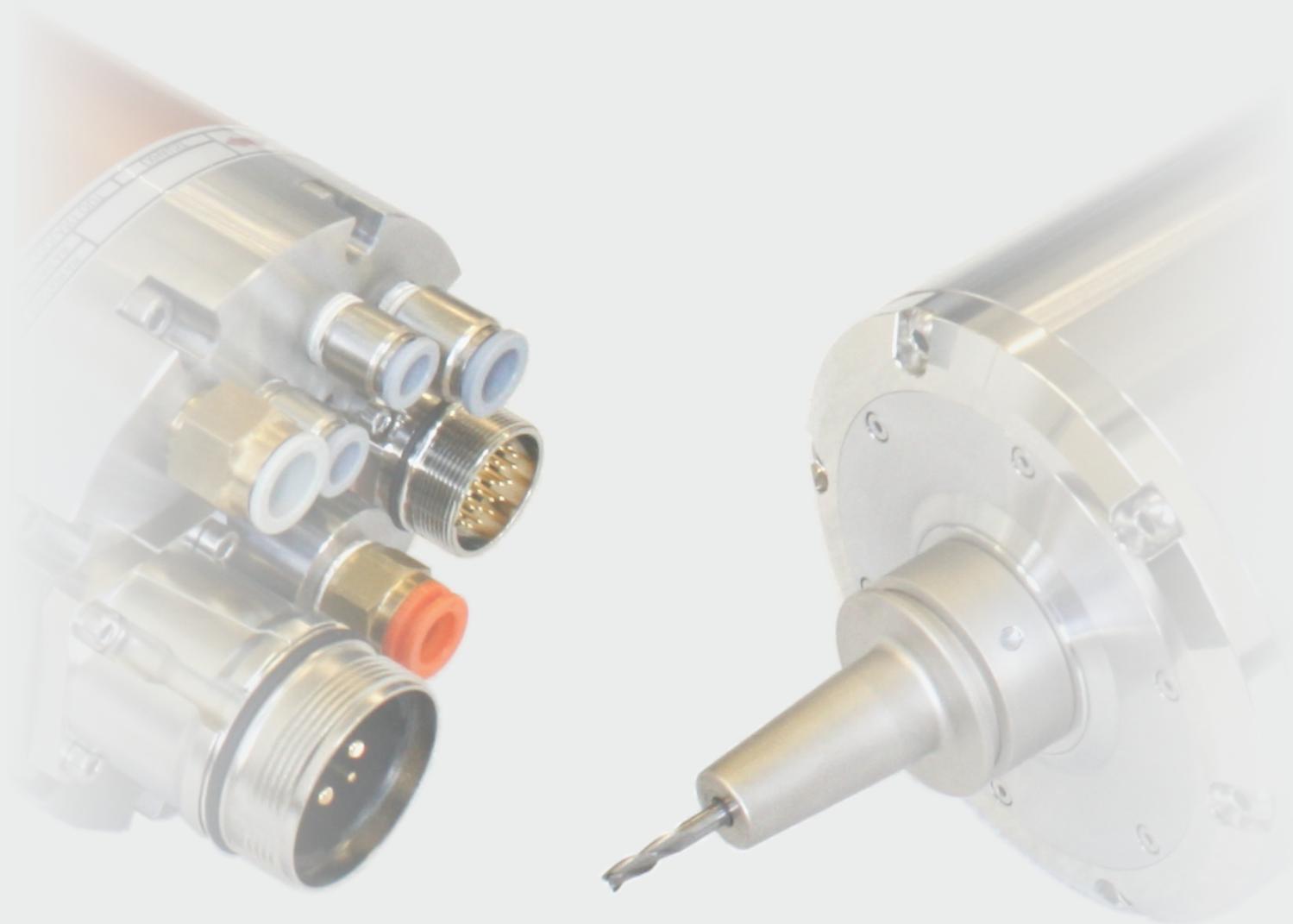




 **LEVITRON**
NON-CONTACT PRECISION MOTION

UASD-H40 (HSK-E40)



Levicron

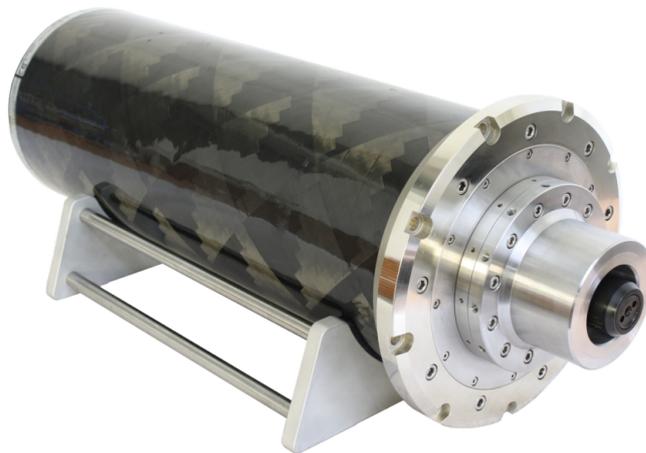
Development, manufacture and sales of motor spindle solutions with non-contact bearing technologies for ultra-precision and CNC machining is Levicron's core business. At Levicron bespoke analytical proven methods and simulation tools for structural analysis and fluid dynamics complement sound practical experiences in the field of spindle development and production.

Being the first ever provider of aerostatic tool spindles with industrial tool interfaces (HSK) and full CNC functionality, products from Levicron are being used all around the world to reliably machine precision parts with an optical surface finish.

Our demands of our products and those from our customers prevent the use of off-the-shelf components within the build. Therefore not only the patented bearing technology and patent-pending spring-free HSK taper clamping systems can be found in our motor spindles, but also in-house developed motor and encoder solutions. A vertical manufacturing integration of more than 90 % incorporates CNC turning, - milling, - diamond machining, - cylindrical /bore grinding and bespoke machining solutions. Along with our production sophisticated test and dynamic balancing methods can all be found under one roof.

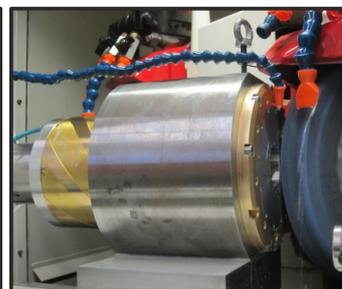
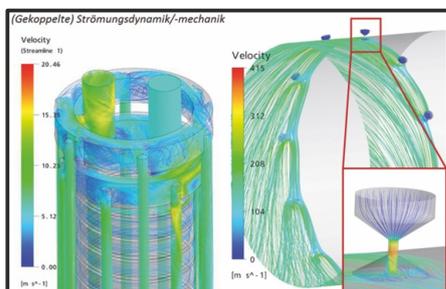
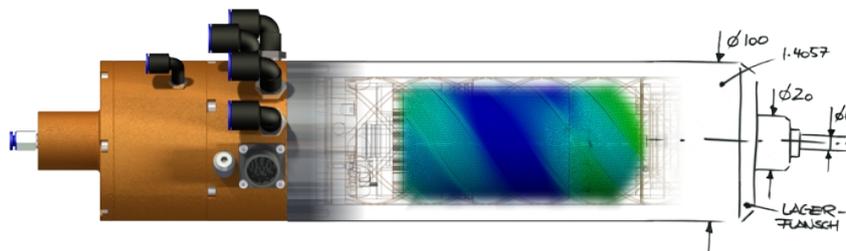
The quality, speed and accuracy of Levicron spindle's and the requirements for the applications they are used in have made it necessary to develop bespoke encoder and motor solutions as well as solutions for HSK tool clamping, HSK tool holding and others. Because of their unique performance and functionality some of these solutions have been made available for our customers as off-the-shelf items. Although Levicron had to re-invented the wheel more than once our customers can confirm that our wheels run better and faster than others.

As a result, tool and work-holding spindle solutions for turning, milling and grinding are offered that provide a unique thermal stability and robustness at shaft dynamics, errors in shaft motion and speeds which were previously not available for the user.



Levicron

All in house developed and manufactured Ultra Precision Technology for CNC Machining



Why aerostatic bearing systems for tool and work-holding spindles?

Although difficult to believe for many engineers, the radial stiffness of our tool and work-holding spindles is indeed comparable with the radial stiffness of actual roller bearing spindles, and the axial stiffness is even higher. Ultra-thin bearing gaps combined with a huge bearing surface, compared to the tiny Hertzian contact in roller bearings, lead to a comparable bearing stiffness and in combination with our high-pressure aerostatic bearing technology to even higher load capacities. Also, bearing gaps with only a few microns in width allow very high shear velocities and compensate for shape errors. This averaging effect of the air film between the shaft and the bearing allows shaft rotations more controlled than those which the sum of all shape errors would normally allow.

Technical benefits:

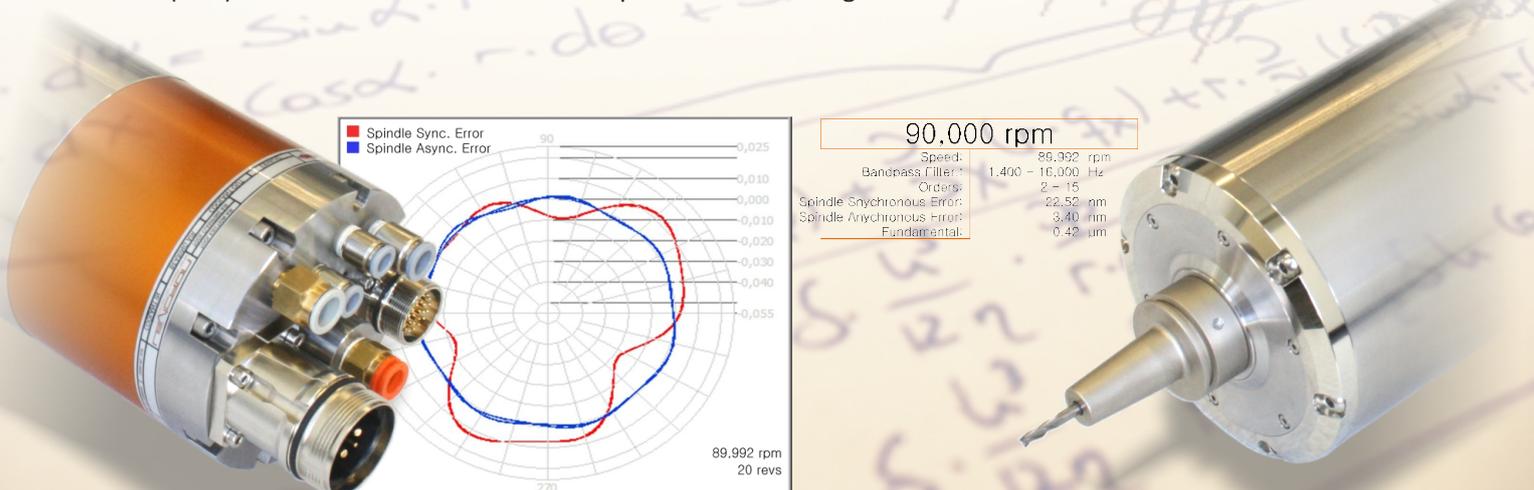
- Higher speeds:
Speeds of up to 100.000 rpm with HSK-E25 tool holders
- Significantly smaller synchronous and asynchronous spindle errors:
Dynamic run-out values < 0.5 micron and errors in shaft motion of < 30 nm at any speed
- Thermal stability:
Spindle soak time < 5 min., axial shaft growth < 5 micron, X/Y stability < 0.5 micron
- Wear-free and stable operation even at top speed
- Modular and service-friendly cartridge design
- Oil and grease-free operation

Customer benefits:

- Higher productivity and reduced tool wear
- Remarkably better surface finishes in any material; suitable for ultra-precision machining
- Stable operation at any speed with no time limit
- Cost-effective assembly due to a modular spindle design
- Oil- and grease-free operation - suitable for medical parts and applications within the food industry

Solutions from Levicron - bespoke solutions to not compromise accuracy and performance:

- Patented bearing technology for outstanding shaft errors in motion, minimized air consumption and spindle stiffness
- Patented automatic and spring-less tool interface for DIN69893 (HSK) taper clamping to give outstanding shaft dynamics and reliability
- Bespoke iron-less motor solutions for ultra-precision machining and high-power motor options with highest power density
- In-house developed integral encoder systems with reduced number of parts and reduced size compared to industry standard
- DIN69893 (HSK) tool holder series UTS-x for ultra-precision machining



UASD-H40

Full-range high-pressure aerostatic tool spindle with automatic spring-less HSK-E40 tool interface

Rough machining with a 10 mm cutter in steel and wear-free, ultra-precise and stable high-speed machining at 60.000 rpm would save the machine user an additional machine to create precision molds and would guarantee optical surface finish at the same time. With our tool spindle model UASD-H40 Levicron have achieved this goal and can now provide a unique true full-range aerostatic CNC tool spindle with HSK-E40 tool clamping and speeds of up to 60,000 rpm.

The patented high-pressure aerostatic bearing system generates a radial and axial load capacity at the tool of up to 3.500 N, but on the other hand also the energy saving, the speed and the ultra-precision operation of our ASD-H25/A with HSK-E25 tool interface. Compared to hydrostatic tool spindles our UASD-H40 offers not only comparable load capacities at 50% less energy costs, remarkably cost savings for peripherals and 50% more spindle speed, but because of the much more simple sealing technology also a very compact and spindle design at low servicing.

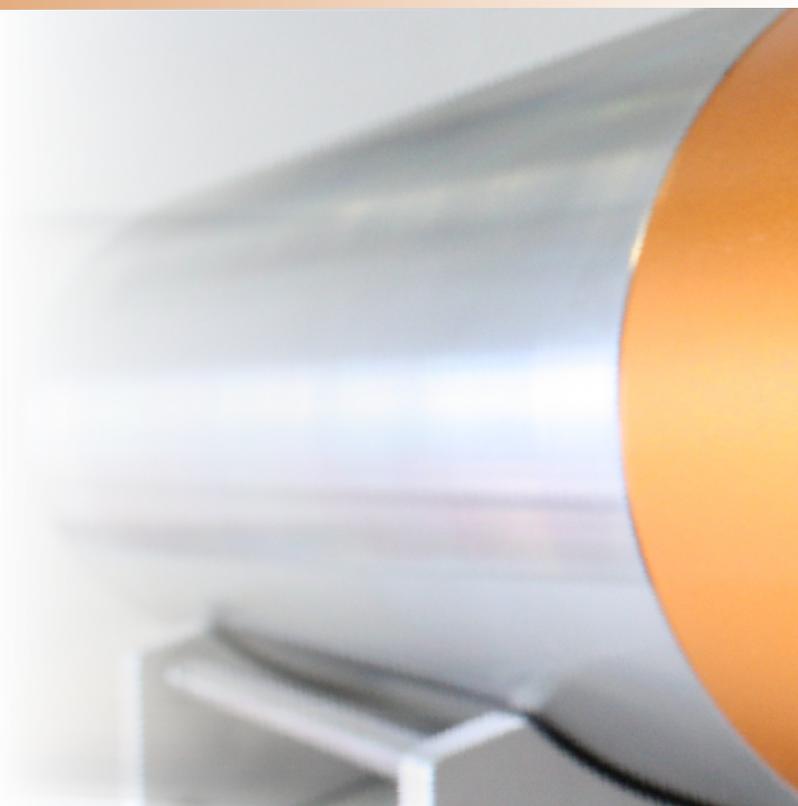
It is designed into a standard size steel housing with 120 mm in diameter, comes with the new in-house developed spring-less automatic HSK-E40 tool clamping and a high-pressure shaft rotary feedthrough capable of leading any gas or fluid at -1 to 60 bar gauge pressure to the tool tip. Our UASD-H40 is the first true full-range aerostatic CNC tool spindle and offers HSK-E40 tool clamping and is capable of speeds of up to 60,000 rpm.

At a glance, UASD-H40

Tool interface	HSK-E40, automatic, spring-less
Motor	3 phases, 2 pole permanentmag. synchronous
	400 V max, 4 Nm / 10.5 kVA S1/100%
Rotary encoder	1 VSS SinCos, 89 lines, zero-flag
Max. Speed	60,000 rpm
Tool change system	pneumatic, 4bit tool clamp status monitoring, taper cleaning air
Cooling	Thin-film liquid cooling
Bearing system	high-pressure aerostatic, 40 - 60 bar
Accuracy, Dynamics	Dynamic tool run-out < 0.5 µm *)
	Error-motion < 50 nm
Axial shaft growth	< 6 micron **)
Rotary feedthrough	Vacuum, air, oil, water based cutting fluids
	0 - 60 bar abs.

*) if used with tool holder series UTS40

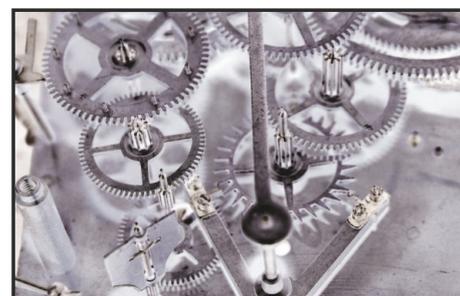
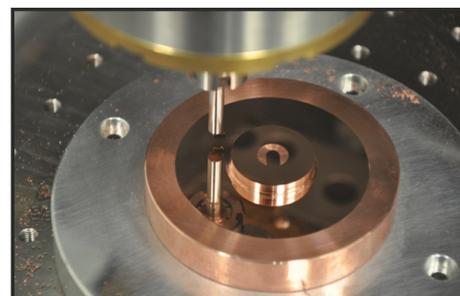
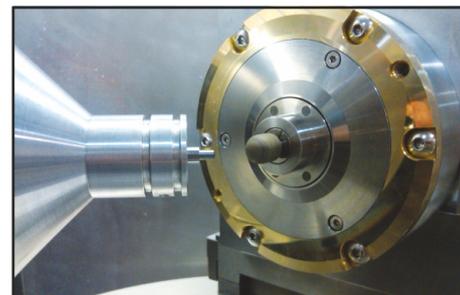
***) from cold / standstill to 60 krpm / warmed through

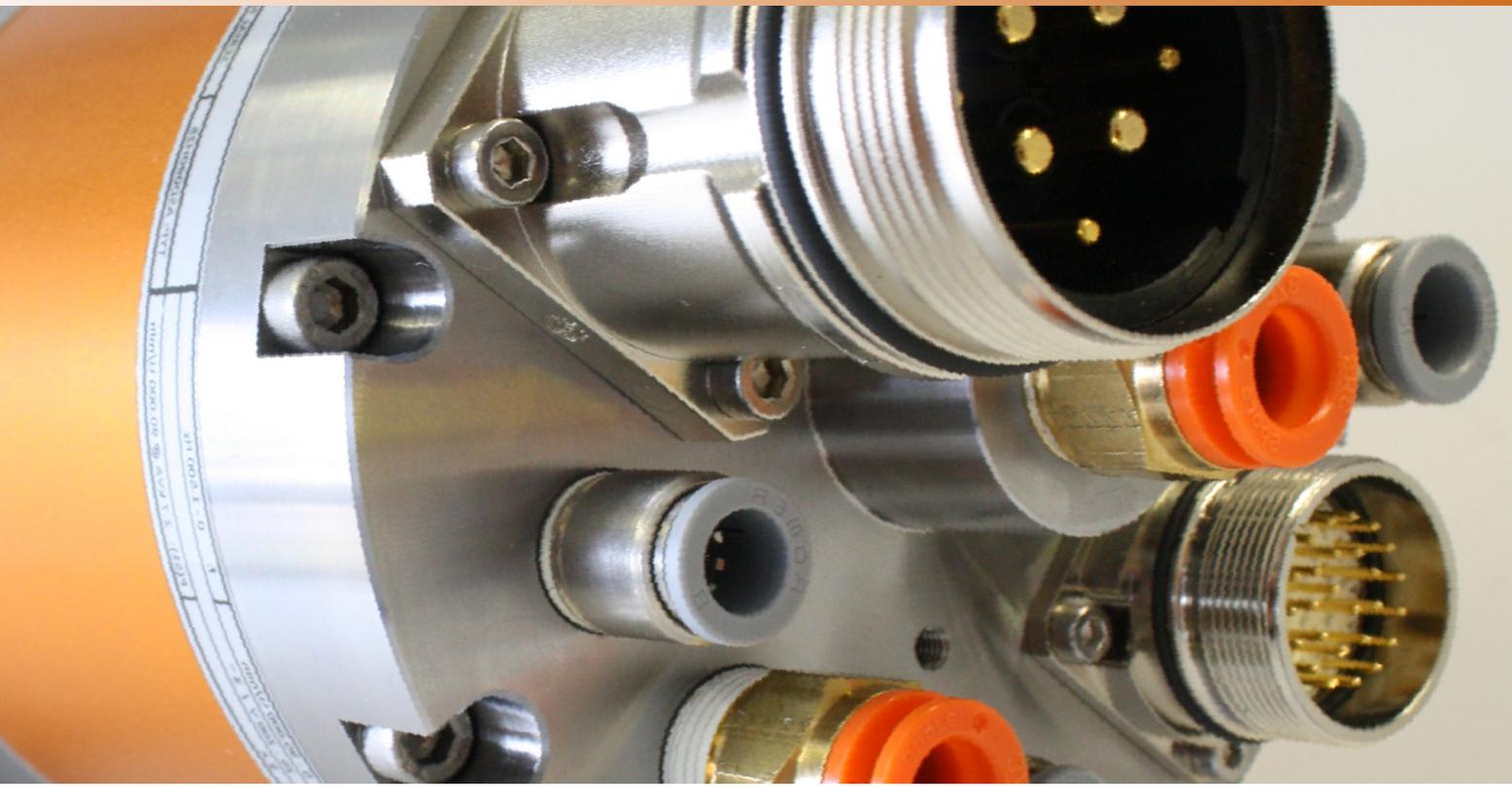


„The way to get rid of temptation is to yield to it.“

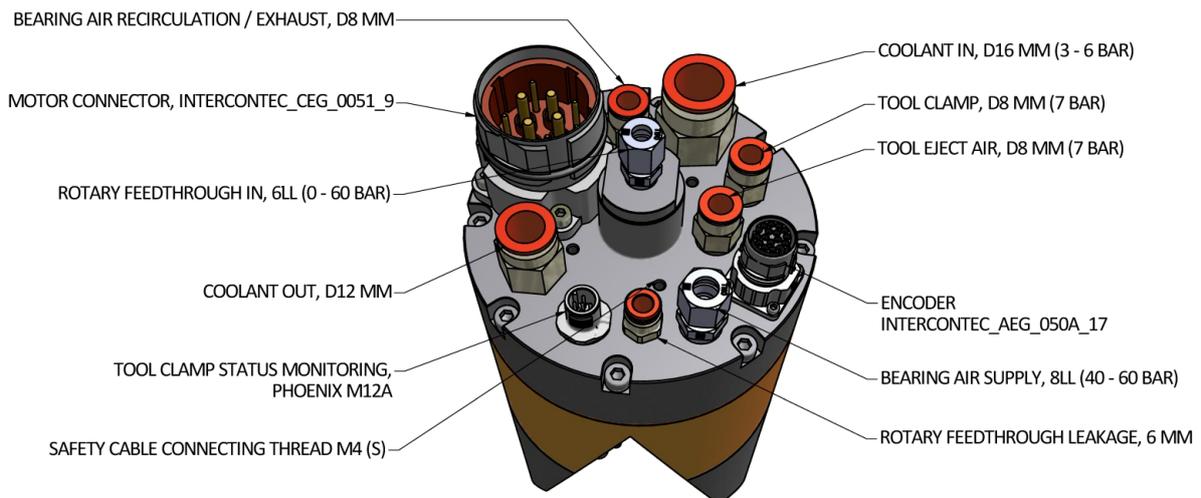
Oscar Wilde

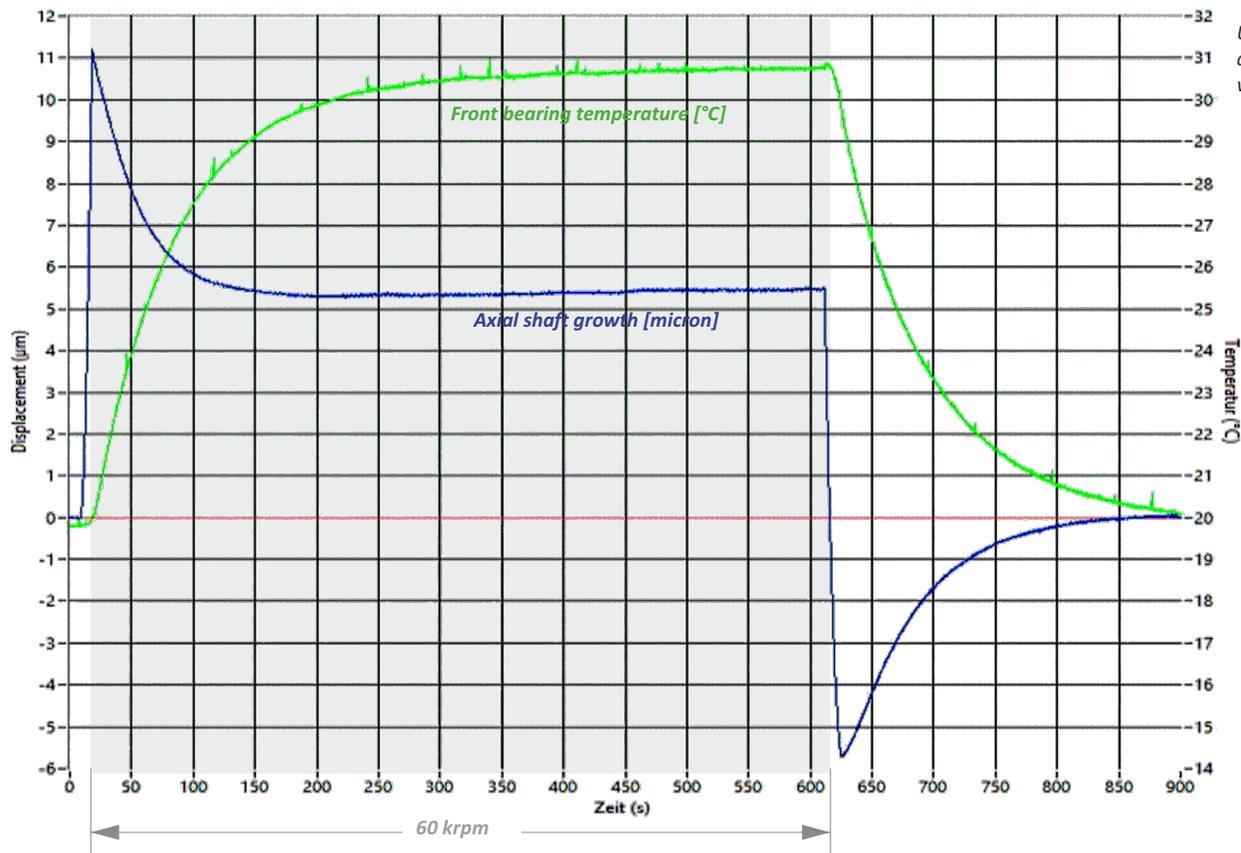
Passionate Precision
Made in Germany





- > **True full-range** ... from roughing to high-speed finishing
- > **Wear-free** ... patented aerostatic bearing system
- > **60% energy saving** ... compared to a hydrostatic spindle
- > **Ultra-sonic safe** ... bearing and tooling system





UASD-H40 - axial shaft growth and front bearing temperature with time from cold and

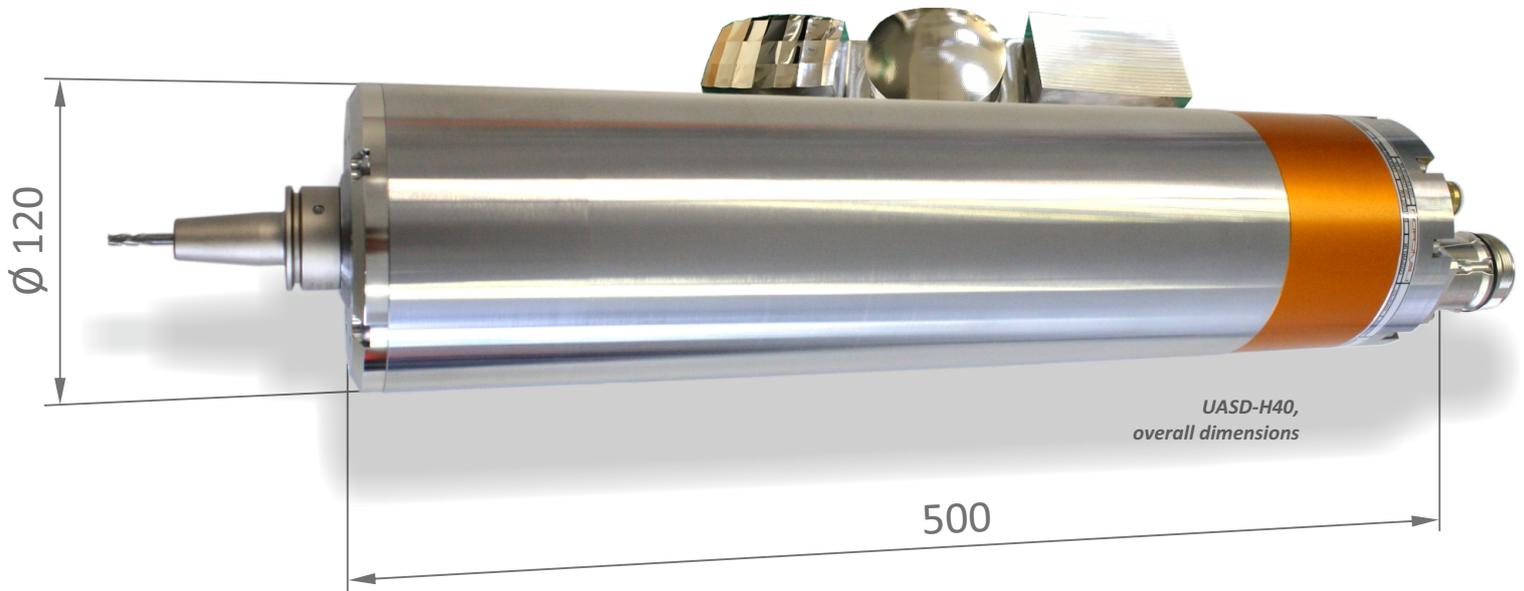
UASD-H40 and UASD-H25/A, comparison

Similar to our spindle model UASD-H25/A with HSK-E25 tool clamping also our UASD-H40 with HSK-E40 tool interface features a high-pressure aerostatic bearing system, but for 40 - 60 bar supply pressure. With this technology both spindle types offer load capacities in the range of hydrostatic spindles, but at a accuracy, thermal stability, and speed level of spindles with aerostatic bearings. Where with oil-hydrostatic bearings not only a costly and complex sealing technology is required, but also a tremendously high power input at higher rotation speeds, high-pressure aerostatic bearings allow a simplistic design at only a fracture of input power.

ASD-H40 and UASD-H25/A, test results

		UASD060H40	UASD060H25
Tool interface	[-/-]	HSK-E40	HSK-E25
Air supply pressure	[bar]	40 - 60 *)	20 - 30 **)
Speed	[krpm]	0 - 60	0 - 60
Shaft power, S1/100%	[kW]	10.5	4.1
Radial load capacity at spindle nose	[N]	3,500	900
Axial load capacity	[N]	4,500	1,400
Static radial stiffness at spindle nose	[N/µm]	100	83
Static axial stiffness	[N/µm]	120	120
Air consumption	[l/min]	220	90
Dynamic tool run-out	[µm]	< 0.4	< 0.3
Error in Motion	[nm]	< 35	< 28

*) values taken at 60 bar supply pressure **) values taken at 20 bar supply pressure



UASD-H40, data sheet

		UASD060H40
General	Body diameter	[mm] 120
	Total length	[mm] 500
	Weight	[kg] 31
	Speed	[Upm] 0 - 60,000
	Automatic tool interface	[-] HSK-E40, spring-less
	Tool clamp status monitoring	[-] analog + PLC
	Rotary feedthrough medium	[-] vacuum, air, oil, emulsion
	Rotary feedthrough gauge pressure range	[bar] -1 - 60
Motor	Type	[-] 3 phases, synchronous
	Constant torque, S1 / 100 %	[Nm] 3.8
	Poles	[-] 2
	Max. phase voltage, RMS	[V] 380
	Rated current, S1 / 100 %	[A] 30
	Peak current, RMS	[A] 60
	Shaft Power, S1 / 100 %	[kVA] 10.5
Rotary encoder	Type	[-] incremental
	Lines	[-] 89
	Signal A/B	[-] 1VSS SinCos
	Zero flag	[-] yes (digital/analog)
Bearing system	Bearing air supply pressure	[bar] 40 - 60
	Air cleanliness, ISO8573	[-] 3, or any better
	Static radial zero position stiffness at spindle nose	[N/μm] > 100
	Static radial load capacity at spindle nose	[N] > 3,500
	Static axial zero position stiffness	[N/μm] > 120
	Axial load capacity	[N] > 4,500
Stability and precision	Taper run-out TIR	[nm] < 100
	Shaft error in motion	[nm] < 40
	Dyanmic tool run-out *)	[μm] < 0.6
	Spindle soak time	[min] < 5
	Axial shaft growth	[μm] < 6

All values taken at 60 bar bearing air supply pressure (gauge pressure)



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