

**LEVICON**  
NON-CONTACT PRECISION MOTION

ASD-H20A / UASD-H20A (HSK-E20, axial spindle connectors)





Levicron

The development, manufacturing, and sales of motor spindle solutions with non-contact bearing technologies for ultra-precision and CNC machining are Levicron’s core businesses.

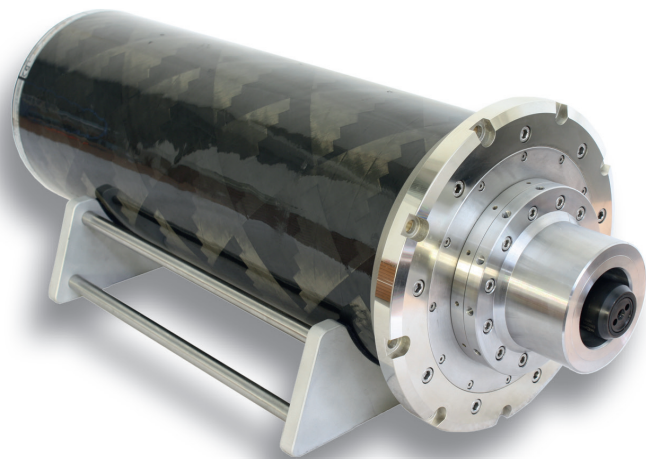
At Levicron, bespoke proven analytical methods and simulation tools for structural analysis and fluid dynamics complement sound practical experience of spindle development and production. Together with the first-ever aerostatic tool spindle comprising an industrial taper interface (HSK) and full CNC functionality, products from Levicron are now used for CNC-machine precision parts with optical surface finish all around the world.

Our requirements for our products and those of our customers prevent the use of off-the-shelf components. 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, encoder and tool clamping solutions.

A vertical manufacturing integration of more than 90 % incorporates CNC turning, -milling, -diamond machining, -cylindrical/ bore grinding, -wire cut EDM, and bespoke machining solutions. You can find all our sophisticated production tests and dynamic balancing methods under one roof.

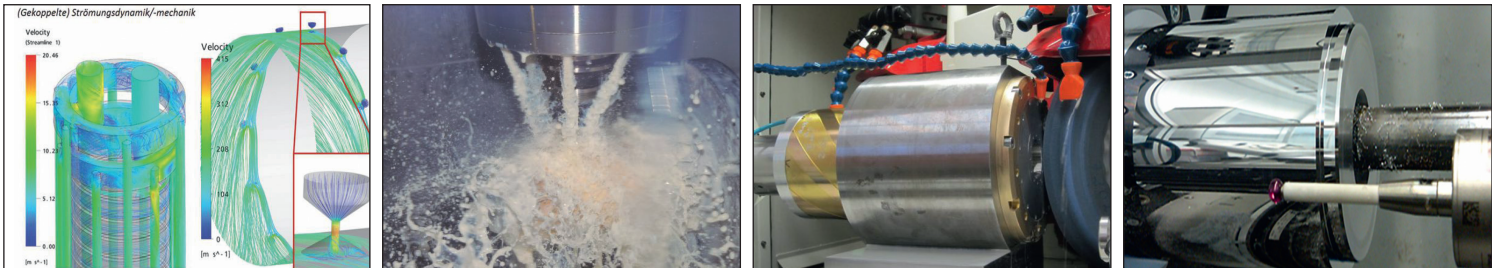
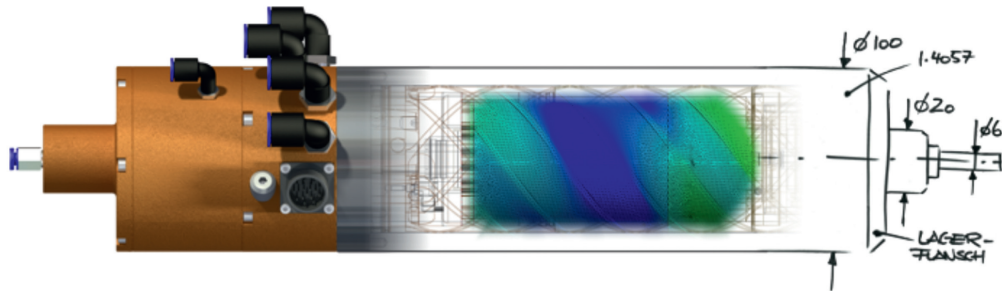
The quality, speed, and accuracy of Levicron spindles and the requirements coming from the applications are used to make it necessary to develop bespoke encoder and motor solutions as well as solutions for HSK tool clamping, HSK tool holding, and others. Because of their unique performance and functionality, some solutions have been made available for our customers as off-the-shelf items.

Although Levicron had to reinvent the wheel more than once, our customers can confirm that our wheels run smoother and faster than others. As a result, tool and work-holding spindle solutions for turning, milling, and grinding can provide the customer with unique thermal stability and robustness at shaft dynamics, errors in shaft motion, and speeds that have not been available so far.



Levicron

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



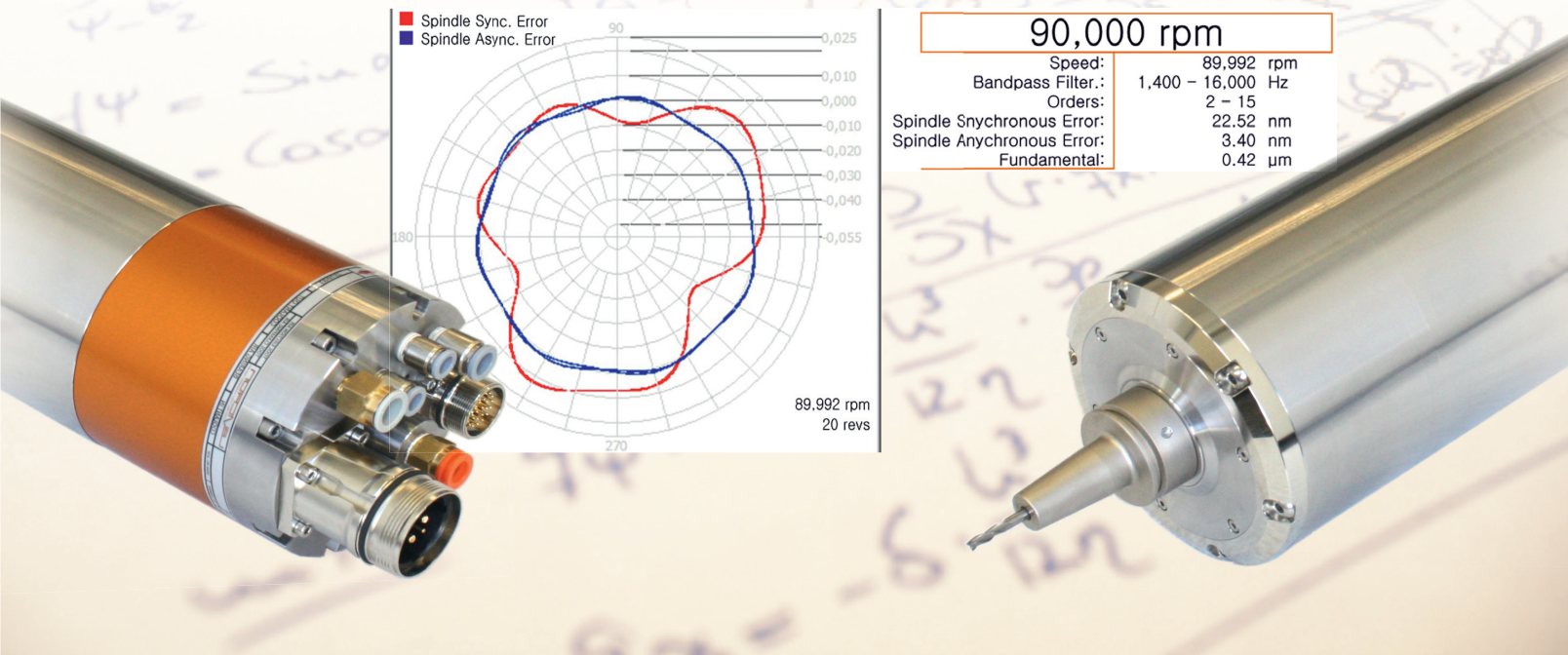
Why aerostatic bearing systems for tool and work-holding spindles?

Although it is difficult to believe for many engineers that the radial stiffness of our tool and work-holding spindles is comparable with the radial stiffness of actual roller-bearing spindles, the axial stiffness can even be higher. Compared to the tiny Hertzian contact in a roller bearing, ultra-thin bearing gaps combined with a large bearing surface lead to a comparable bearing stiffness. Combined with our high-pressure aerostatic bearing technology, it leads 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 a shaft rotation more controlled than the sum of all shape errors.

Technical benefits	Customer benefits
<ul style="list-style-type: none"><li>• Higher speeds: speeds of up to 100,000 rpm with HSK-E25 tool holders</li><li>• Significantly more minor synchronous and asynchronous spindle errors: dynamic run-out values &lt; 0.5 micron and errors in shaft motion of &lt; 30 nm at any speed</li><li>• Thermal stability: spindle soak time &lt; 5 min., axial shaft growth &lt; 5 micron, X/ Y stability &lt; 0.5 micron</li><li>• Wear-free and stable operation even at top speed</li><li>• Modular and service-friendly cartridge design</li><li>• Oil and grease-free operation</li></ul>	<ul style="list-style-type: none"><li>• Higher productivity and reduced tool wear</li><li>• Remarkably better surface finishes in any material; suitable for ultra-precision machining</li><li>• Stable operation at any speed with no time limit</li><li>• Cost-effective assembly due to a modular spindle design</li><li>• Oil- and grease-free operation suitable for medical parts and applications within the food industry</li></ul>

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

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





ASD-H20A / UASD-H20A

Ultra-precise aerostatic tool spindles with automatic, springless HSK-E20 tool clamping and axially outgoing spindle connections.

Description

The highest speeds, precision, stability, and automation combine our new tool spindle (U)ASD-H20A. It was developed specifically for the long outstanding requirements for producing of integrated semiconductor devices and optoelectronic components. Speeds up to 150,000 rpm, an automatic springless **HSK-E20** interface, tool clamping monitoring, and optimized thermal/ dynamic behavior allow fully automated machining of small and integral components.

What is the added value?

As a result, the user in CNC machining gets unprecedented precision, thermal stability, and the ability to machine optical surfaces in milling and grinding applications. In turn, the user in ultra-precision machining gets the possibility of high chip removal and automated tool change for a significant increase in productivity and automation. But high speeds and fully automated integration into production lines are only two basic requirements. Using our springless, patented HSK clamping system SLH-x in size **HSK-20**, a consistent optimization of the shaft dynamics, and the highly efficient and symmetrical thin-film liquid cooling, our **ASD-H20A** also offers unrivaled dynamic and thermal stability to previous solutions.

At a glance, ASD-H20A / UASD-H20A

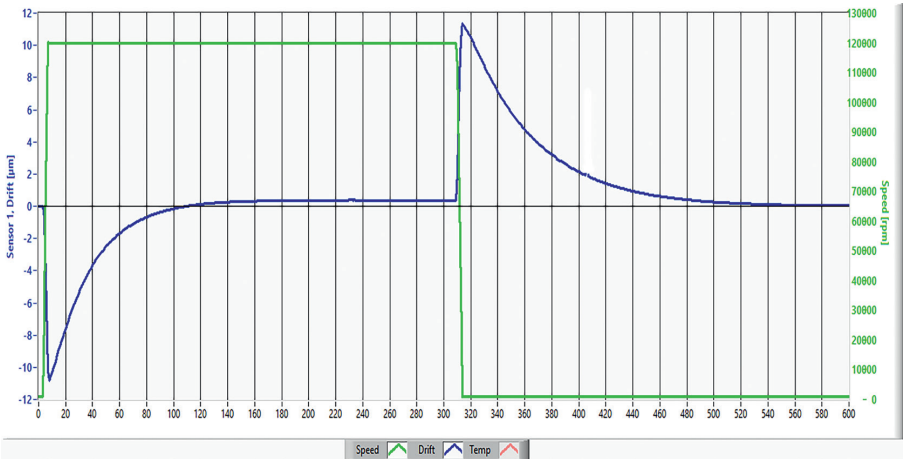
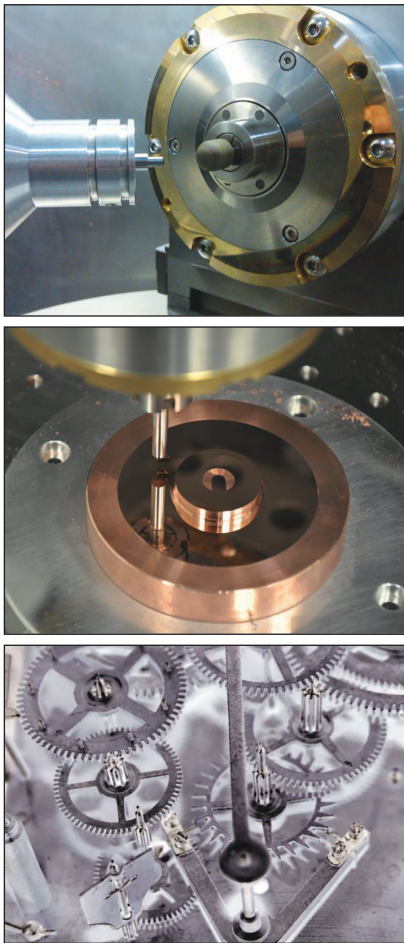
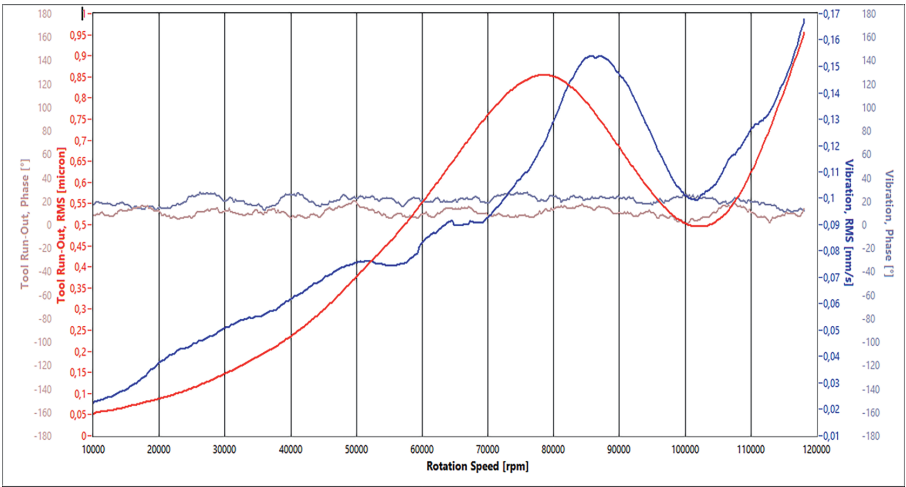
Tool interface	HSK-E20, automatic, spring-less (SLH20)
Body diameter	80 mm
Motor options	400 V max., high-power, 0.22 Nm S1 (Option) 200 V max., high-power, 0.22 Nm S1 200 V max., iron-less, 0.13 Nm S1
Angular position control	1 VSS SinCos, 60 lines, zero flag
Nominal speed	120,000 rpm 150,000 rpm
Tool change system	pneumatic, 4bit tool clamp status monitoring, taper cleaning air
Spindle cooling	thin-film liquid cooling
Bearing system	aerostatic (ASD-H20A) high-pressure aerostatic (UASD-H20A)
Accuracy, dynamics	dynamic tool run-out < 1 micron *)
Axial shaft growth	< 1 micron; < 3 minutes **)
Cutting fluid feedthrough	n.a.
Spindle connectors	axially oriented (Dmax 80mm)

\*) if used with the tool holders series UTS-20  
\*\*) from cold/ standstill to 120,000 rpm/ heated through



Dynamic tool run-out

The intensive optimization of the shaft dynamics and the patented bearing technology's stiffness result in operation under all stiffness- and bending-critical natural frequencies for all speeds. This is reflected accordingly in the dynamic basic tool run and the oscillating speeds. These properties even allow tool diameters smaller than 50 micron, with significantly reduced tool wear and without the tool breaking due to vibrations of a resonance case (rotational frequency = critical).



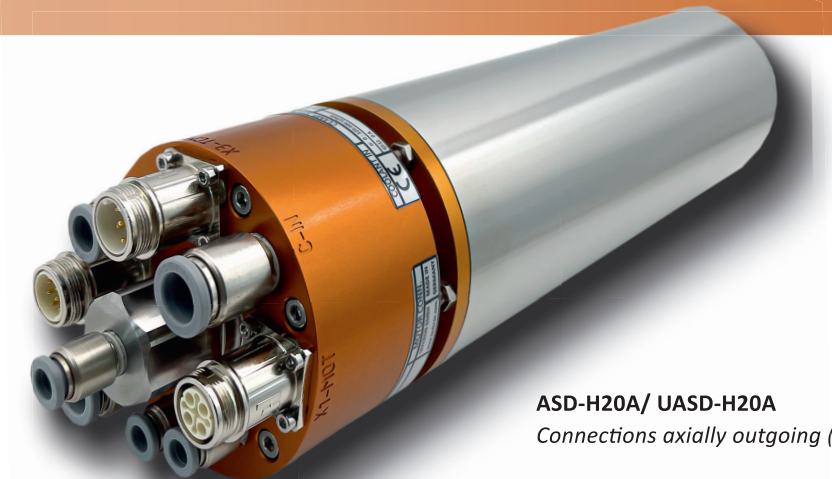
Axial shaft growth

The warm through time is < 3 minutes. The axial shaft growth from the cold condition and standstill to 120,000 rpm and warmed through: < 1 micron.





ASD-H20A/ UASD-H20A  
with UTS-x tool holder („front view“)



ASD-H20A/ UASD-H20A  
Connections axially outgoing („rear view“)

Data Sheet ASD-H20A

		ASD120H20A	ASD150H20A
General	Body diameter [mm]	80	80
	Total length [mm]	335	335
	Weight [kg]	8.1	8.1
	Speed [rpm]	0 - 120,000	0 - 150,000
	Automatic tool interface [-]	HSK-E20, spring-less	HSK-E20, spring-less
	Tool clamp status monitoring [-]	4bit digital	4bit digital
Motor option „high-power“, 400 V max. (Option)	Type [-]	3 phases, BL-DC	3 phases, BL-DC
	Constant torque [Nm]	0.22	0.22
	Poles [-]	2	2
	max. phase voltage, RMS [V]	300	380
	Rated current [A]	5	5
	Peak current, RMS [A]	10	10
	Shaft power [kVA]	2.5	2.8
Motor option „high-power“, 200 V max.	Type [-]	3 phases, BL-DC	3 phases, BL-DC **)
	Constant torque [Nm]	0.22	0.22
	Poles [-]	2	2
	max. phase voltage, RMS [V]	165	190
	Rated current [A]	9.5	9.5
	Peak current, RMS [A]	19	19
Motor option „iron-less“, 200 V max.	Type [-]	3 phases, BL-DC	3 phases, BL-DC
	Constant torque [Nm]	0.13	0.13
	Poles [-]	2	2
	max. phase voltage, RMS [V]	170	195
	Rated current [A]	5	5
	Peak current, RMS [A]	10	10
Rotary encoder	Shaft power [kVA]	1.6	1.9
	Type [-]	incremental	incremental
	Lines [-]	60	60
	Signal A/B [-]	SinCos, 1 VSS	SinCos, 1 VSS
Bearing system	Zero flag [-]	yes (digital/ analog)	yes (digital/ analog)
	Bearing air supply pressure [bar]	6 - 10	6 - 10
	Air cleanliness, ISO8573 [-]	3 or better	3 or better
	Static radial zero position stiffness at the spindle nose [N/μm]	> 16	> 20
	Static radial load capacity at the spindle nose [N]	160 - 200	> 190
	Static axial zero position stiffness [N/μm]	> 21	> 25
Stability and precision	Axial load capacity [N]	> 240	> 230
	Taper run-out TIR [nm]	< 100	< 100
	Shaft error in motion [nm]	< 40	< 50
	Dynamic tool run-out *) [μm]	< 1	< 1.3
	Spindle soak time [min]	< 3	< 4
	Axial shaft growth [μm]	< 3	< 4

all values are taken at 6 bar bearing air supply pressure  
\*) if used with the UTS-20 tool holder series  
\*\*) only in a field-weakened operation

Data Sheet UASD-H20A

		UASD120H20A	UASD150H20A
General	Body diameter [mm]	80	80
	Total length [mm]	335	335
	Weight [kg]	8.1	8.1
	Speed [rpm]	0 - 120,000	0 - 150,000
	Automatic tool interface [-]	HSK-E20, spring-less	HSK-E20, spring-less
	Tool clamp status monitoring [-]	4bit digital	4bit digital
Motor option „high-power“, 400 V max. (Option)	Type [-]	3 phases, BL-DC	3 phases, BL-DC
	Constant torque [Nm]	0.22	0.22
	Poles [-]	2	2
	max. phase voltage, RMS [V]	300	380
	Rated current [A]	5	5
	Peak current, RMS [A]	10	10
	Shaft power [kVA]	2.5	2.8
Motor option „high-power“, 200 V max.	Type [-]	3 phases, BL-DC	3 phases, BL-DC **)
	Constant torque [Nm]	0.22	0.22
	Poles [-]	2	2
	max. phase voltage, RMS [V]	165	190
	Rated current [A]	9.5	9.5
	Peak current, RMS [A]	19	19
Motor option „iron-less“, 200 V max.	Shaft power [kVA]	2.5	2.8
	Type [-]	3 phases, BL-DC	3 phases, BL-DC
	Constant torque [Nm]	0.13	0.13
	Poles [-]	2	2
	max. phase voltage, RMS [V]	170	195
	Rated current [A]	5	5
Rotary encoder	Peak current, RMS [A]	10	10
	Shaft power [kVA]	1.6	1.9
	Type [-]	incremental	incremental
	Lines [-]	60	60
Bearing system	Signal A/B [-]	SinCos, 1 VSS	SinCos, 1 VSS
	Zero flag [-]	yes (digital/ analog)	yes (digital/ analog)
	Bearing air supply pressure [bar]	20 - 30	20 - 30
	Air cleanliness, ISO8573 [-]	3 or better	3 or better
	Static radial zero position stiffness at the spindle nose [N/μm]	> 24	> 38
	Static radial load capacity at the spindle nose [N]	280 - 310	> 580
Stability and precision	Static axial zero position stiffness [N/μm]	> 30	> 45
	Axial load capacity [N]	> 650	> 630
	Taper run-out TIR [nm]	< 100	< 100
	Shaft error in motion [nm]	< 45	< 55
	Dynamic tool run-out *) [μm]	< 1	< 1.3
	Spindle soak time [min]	< 3	< 4
	Axial shaft growth [μm]	< 3	< 4

all values are taken at 20 bar bearing air supply pressure  
\*) if used with the UTS-20 tool holder series  
\*\*) only in a field-weakened operation





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