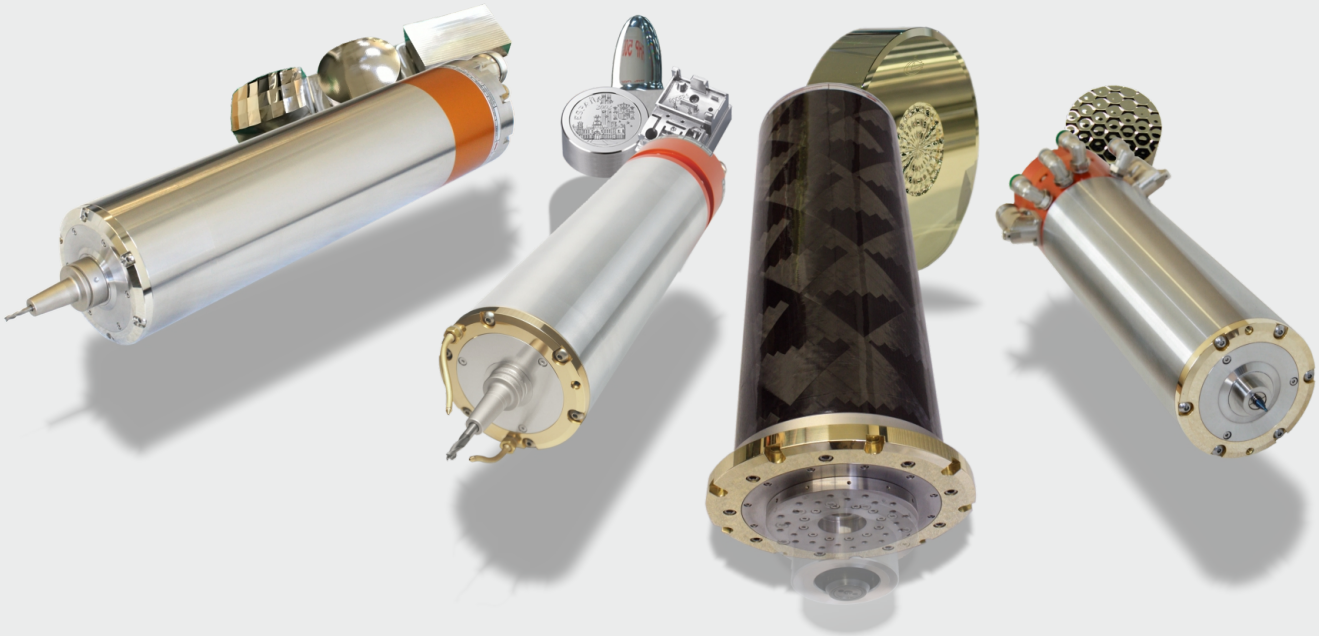
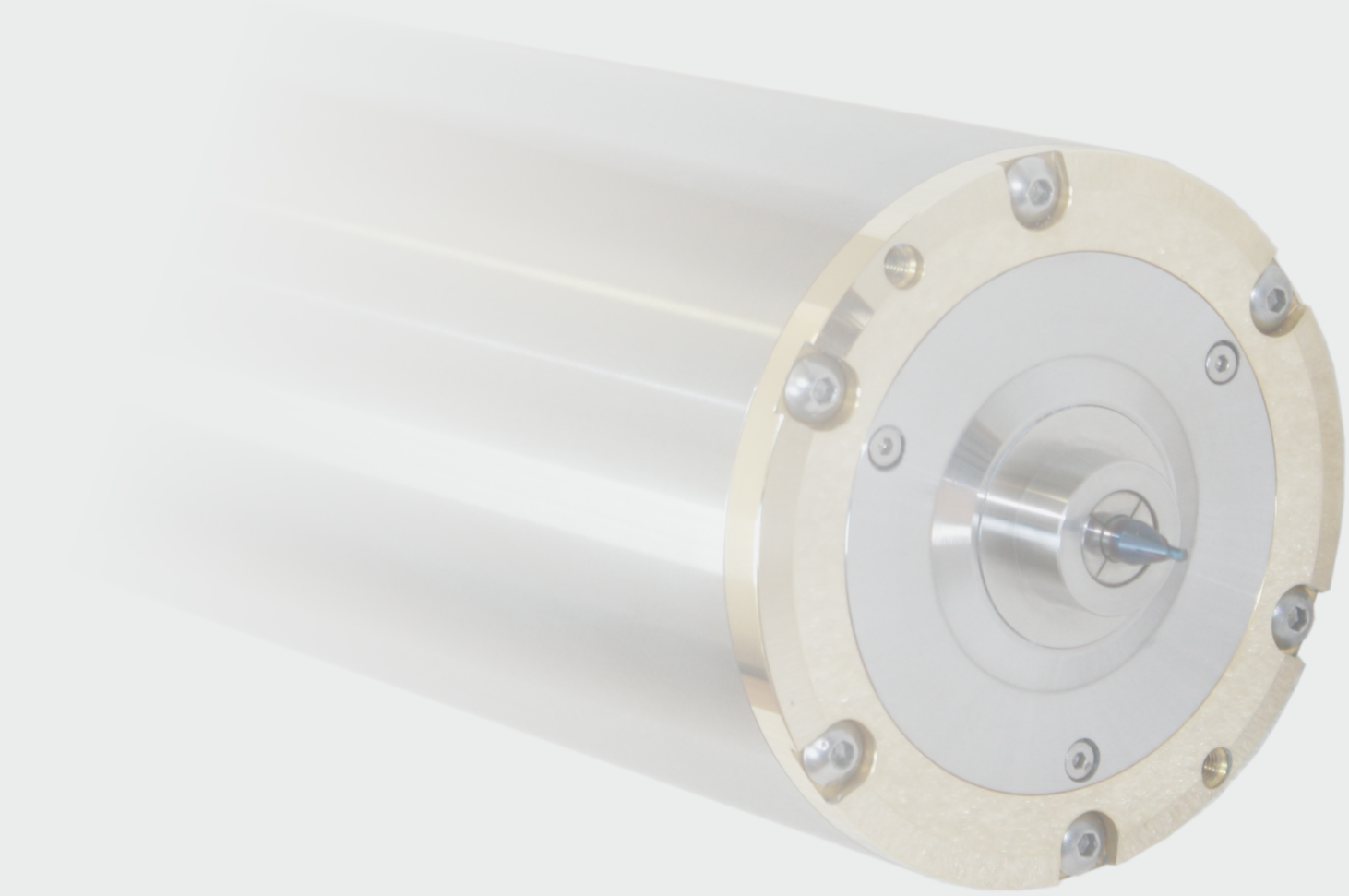


LEVICRON

NON-CONTACT PRECISION MOTION

ASD-Cx / UASD-Cx (automatic direct tool shank clamping)



Levicron

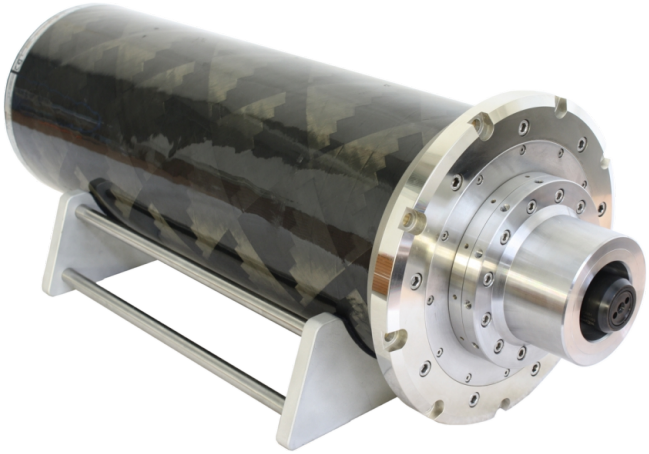
Development, manufacture and sales of motor spindle solutions with non-contact bearing technologies for ultra-precision and CNC machining is Levicron's core business. At Levicron bespoke analytical proven methods and simulation tools for structural analysis and fluid dynamics complement sound practical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

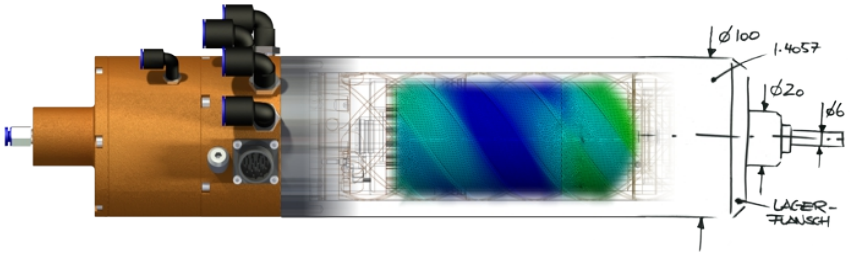
The quality, speed and accuracy of Levicron spindle's and the requirements for the applications they are used in have made it necessary to develop bespoke encoder and motor solutions as well as solutions for HSK tool clamping, HSK tool holding and others. Because of their unique performance and functionality 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.

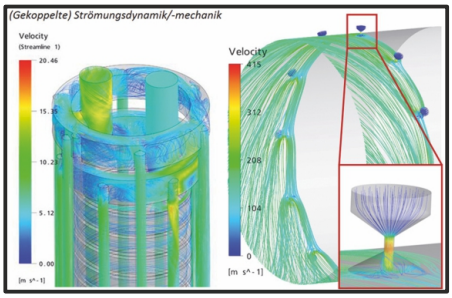
As a result, tool and work-holding spindle solutions for turning, milling and grinding are offered that provide a unique thermal stability and robustness at shaft dynamics, erros in shaft motion and speeds which were previosly not available for the user.

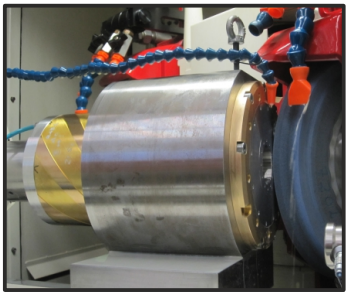


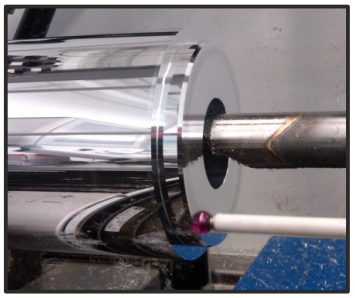
Levicron

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:

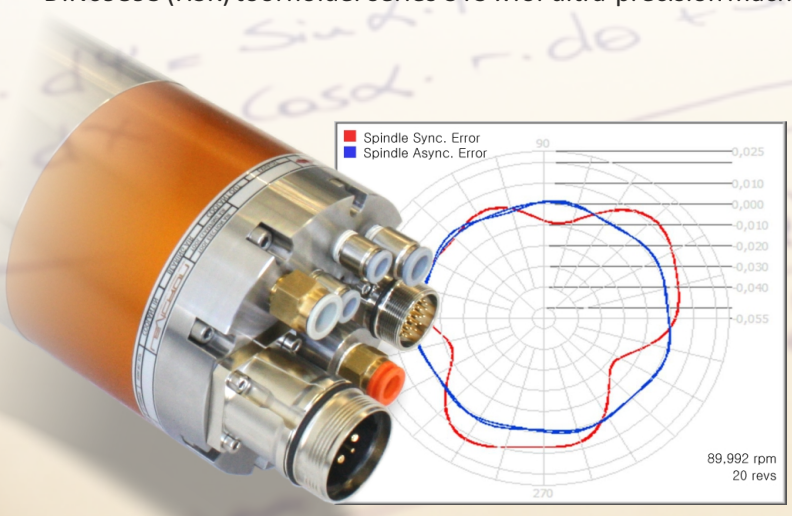
- Higher speeds:
  Speeds of up to 100.000 rpm with HSK-E25 tool holders
- Significantly smaller synchronous and asynchronous spindle errors:
  Dynamic run-out values < 0.5 micron and errors in shaft motion of < 30 nm at any speed
- Thermal stability:
  Spindle soak time < 5 min., axial shaft growth < 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

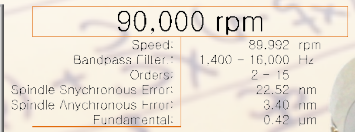
Customer benefits:

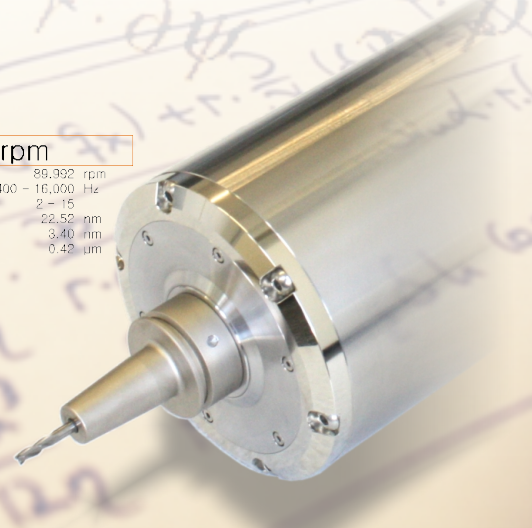
- Higher productivity and reduced tool wear
- Remarkably better surface finishes in any material; suitable for ultra-precision machining
- Stable operation at any speed with no time limit
- Cost-effective assembly due to a modular spindle design
- Oil- and grease-free operation - suitable for medical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







ASD-Cx / UASD-Cx

Ultra-precision aerostatic motor spindle with automatic direct tool shank clamping

Our spindle models ASD-Cx and UASD-Cx fulfill all your requirements on a high-quality high-speed CNC tool spindle to generate high-precision parts with optical surface finish. They combine robustness and CNC functionality with high shaft speeds for micro milling and micro drilling as well as low errors in shaft motion to machine optical components. Both models feature a very robust and precise automatic direct tool shank clamping system, a high-resolution rotary encoder, a highly efficient thin-film liquid cooling and a steel housing with a standardized diameter.

If used in CNC machine tools the user not only gets outstanding precision, thermal stability and speed, but also for the first time ever the ability to create parts with an optical surface finish. Also, for ultra-precision machining our ASD-Cx and UASD-Cx now enable significantly increased chip loads and an automated tool change to increase productivity at an ultra precision level.

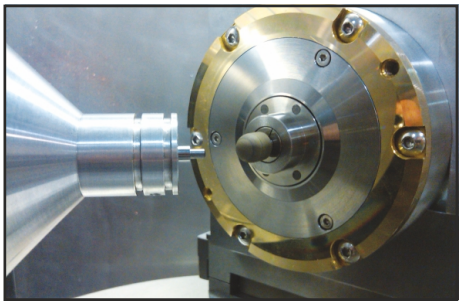
„The way to get rid of temptation is to yield to it.“
Oscar Wilde

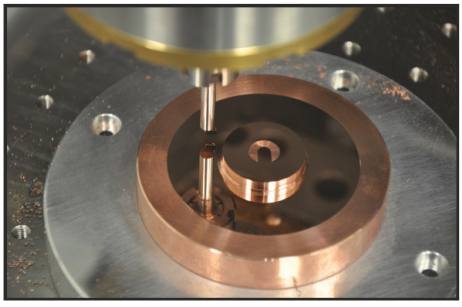
Passionate Precision
Made in Germany

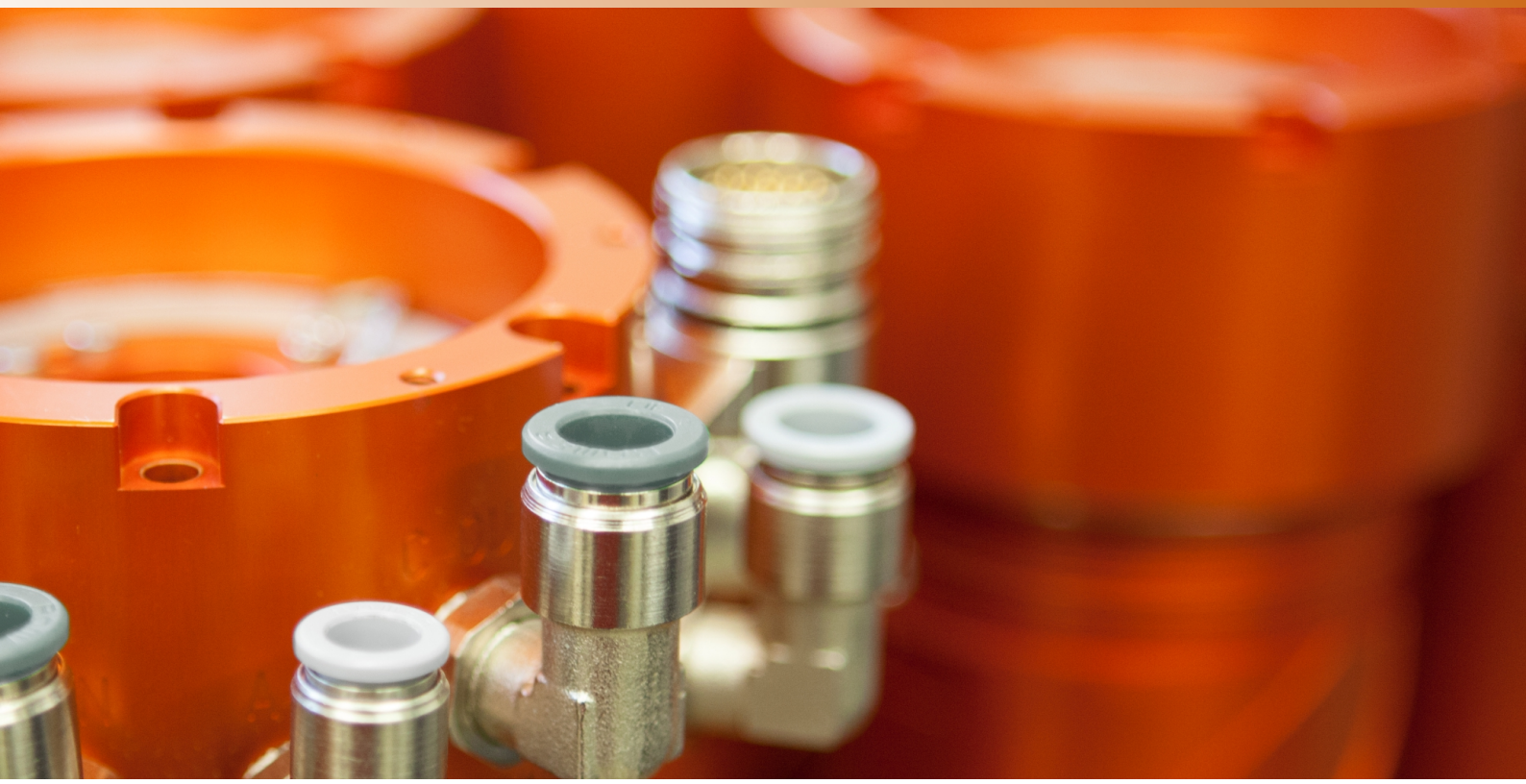
At a glance, ASD-Cx / UASD-Cx

Available clamping diameters	1/4"
	6 mm
	4 mm
	1/8"
	3 mm
Motor options	400 V max., high-power, 0.66 Nm S1
	208 V max., high-power, 0.66 Nm S1
	400 V max., iron-less, 0.33 Nm S1
	208 V max., iron-less, 0.33 Nm S1
Position control	1 VSS SinCos, 80 lines, zero-flag
Nominal speed	60,000 rpm
	80,000 rpm
	90,000 rpm
Tool change system	pneumatic, taper cleaning air
Cooling	Thin-film liquid cooling
Bearing system	aerostatic, 6 - 10 bar (ASD-Cx)
	high-pressure aerostatic, 20 - 30 bar (UASD-Cx)
Accuracy, Dynamics	Dynamic tool run-out < 0.5 µm *)
	Error-motion < 30 nm
Connectors	radially oriented

*) if used with tool holder series UTS25







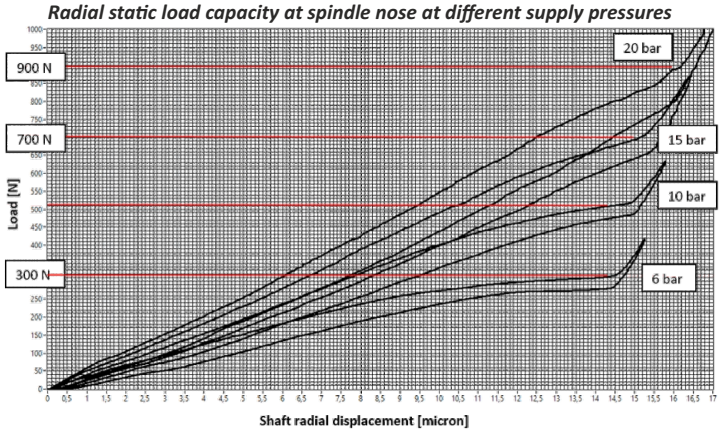
ASD-Cx and UASD-Cx, Comparison

The aerostatic bearing system of the UASD-Cx type spindles has specifically been designed and manufactured for the use with air supply pressures of 20 - 30 bar. The result is an increase in load capacity at the spindle nose of approximately 300 % compared to the standard models.

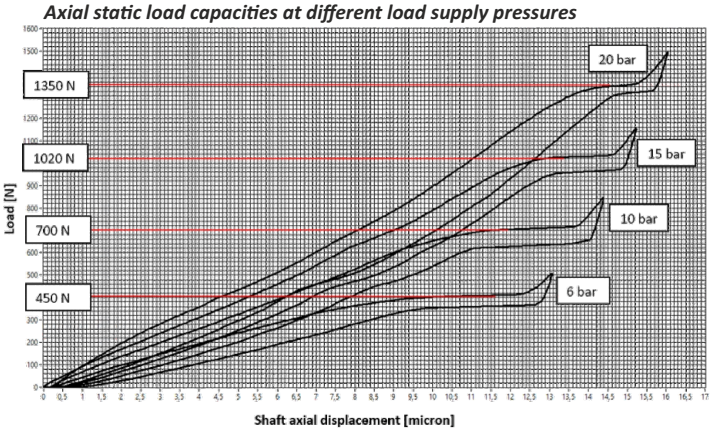
The new axial bearing and bearing orifice design reduce the air consumption significantly to provide economic operation even at higher supply pressures.

An alternative air compressor to your machines standard may be required to operate UASD-x models.

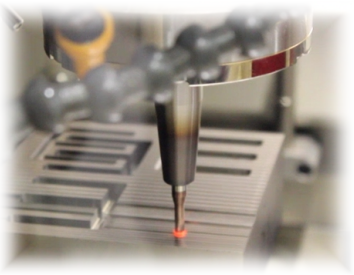
Radial static load capacity at spindle nose at different supply pressures



Axial static load capacities at different load supply pressures



ASD-Cx and UASD-Cx test results		ASD060Cx	UASD060Cx
Bearing air supply pressure	[bar]	6 - 10	20 - 30
Speed	[krpm]	0 - 60	0 - 60
Radial load capacity at spindle nose	[N]	330	900 (275%)
Axial load capacity	[N]	550	1400 (255%)
Static radial stiffness at spindle nose	[N/µm]	41	83 (202%)
Static axial stiffness	[N/µm]	65	120 (180%)
Static air consumption	[Nl/min]	50	90 (180%)
Dynamic tool run-out	[µm]	< 0.4	< 0.3
Shaft error in motion	[nm]	< 23	< 28



ASD-Cx / UASD-Cx,
„Front view“

Datenblatt ASD-Cx

			ASD060Cx	ASD080Cx	ASD100Cx
General	Body diameter	[mm]	100	100	100
	Total length	[mm]	415	415	415
	Weight	[kg]	16	16	16
	Speed	[Upm]	0 - 60,000	0 - 80,000	0 - 100,000
	Automatic tool interface	[-]	direct shank clamping	direct shank clamping	direct shank clamping
	Available clamping diameters	[mm]	6, 4, 3	6, 4, 3	6, 4, 3
	Available clamping diameters	[Inch]	1/4, 1/8	1/4, 1/8	1/4, 1/8
Motor option "high-power", 400 V max.	Type	[-]	3 phases, synchronous	3 phases, synchronous	n. v.
	Constant torque	[Nm]	0,66	0,66	
	Poles	[-]	2	2	
	max. phase voltage, RMS	[V]	300	370	
	Rated current	[A]	10	10	
	Peak current, RMS	[A]	20	20	
	Shaft Power	[kVA]	4.1	5.5	
Moto option "high-power", 208 V max.	Type	[-]	3 phases, synchronous	3 phases, synchronous	3 phases, synchronous **)
	Constant torque	[Nm]	0.66	0.66	0.66
	Poles	[-]	2	2	2
	max. phase voltage, RMS	[V]	160	205	208 (235)
	Rated current	[A]	18	18	18
	Peak current, RMS	[A]	36	36	36
	Shaft Power	[kVA]	4.1	5.5	5.8 (6.8)
Motor option "ultra-precision", 400 V max.	Type	[-]	3 phases, synchronous	3 phases, synchronous	3 phases, synchronous
	Constant torque	[Nm]	0.33	0.33	0.33
	Poles	[-]	2	2	2
	max. phase voltage, RMS	[V]	250	310	380
	Rated current	[A]	5	5	5
	Peak current, RMS	[A]	11	11	11
	Shaft Power	[kVA]	2.1	2.7	3.3
Motor option "ultra-precision", 208 V max.	Type	[-]	3 phases, synchronous	3 phases, synchronous	3 phases, synchronous **)
	Constant torque	[Nm]	0.33	0.33	0.33
	Poles	[-]	2	2	2
	max. phase voltage, RMS	[V]	160	180	208 (220)
	Rated current	[A]	5	5	5
	Peak current, RMS	[A]	11	11	11
	Shaft Power	[kVA]	2.1	2.7	3.0 (3.3)
Rotary encoder	Type	[-]	incremental	incremental	incremental
	Lines	[-]	80	80	80
	Signal A/B	[-]	1 VSS SinCos	1 VSS SinCos	1 VSS SinCos
	Zero flag	[-]	yes (digital/analog)	yes (digital/analog)	yes (digital/analog)
Bearing system	Bearing air supply pressure	[bar]	6 - 10	6 - 10	6 - 10
	Air cleanliness, ISO8573	[-]	3 or better	3 or better	3 or better
	Static radial zero position stiffness at spindle nose	[N/µm]	> 40	> 25	> 20
	Static radial load capacity at spindle nose	[N]	> 330	> 300	> 280
	Static axial zero position stiffness	[N/µm]	> 65	> 45	> 35
	Axial load capacity	[N]	> 600	> 550	> 500
Stability and precision	Taper run-out, TIR	[nm]	< 100	< 100	< 100
	Shaft error in motion	[nm]	< 30	< 30	< 30
	Static tool run-out, TIR	[µm]	< 0.5	< 0.5	< 0.5
	Spindle soak time	[Min]	< 3	< 3	< 3
	Axial shaft growth	[µm]	< 3	< 5	< 7

All values taken at 6 bar bearing supply pressure (gauge pressure)
**) If used with field weakening technology

ASD-Cx / UASD-Cx,
„Rear view“

Datenblatt UASD-Cx

			UASD060Cx	UASD080Cx	UASD100Cx
General	Body diameter	[mm]	100	100	100
	Total length	[mm]	415	415	415
	Weight	[kg]	16	16	16
	Speed	[Upm]	0 - 60,000	0 - 80,000	0 - 100,000
	Automatic tool interface	[-]	direct shank clamping	direct shank clamping	direct shank clamping
	Available clamping diameters	[mm]	6, 4, 3	6, 4, 3	6, 4, 3
	Available clamping diameters	[in]	1/4, 1/8	1/4, 1/8	1/4, 1/8
Motor option "high-powwer", 400 V max.	Type	[-]	3 phases, synchronous	3 phases, synchronous	n. v.
	Constant torque	[Nm]	0.66	0.66	
	Poles	[-]	2	2	
	max. phase voltage, RMS	[V]	300	370	
	Rated current	[A]	10	10	
	Peak current, RMS	[A]	20	20	
	Shaft Power	[kVA]	4.1	5.5	
Moto option "high-power", 208 V max.	Type	[-]	3 phases, synchronous	3 phases, synchronous	3 phases, synchronous **)
	Constant torque	[Nm]	0.66	0.66	0.66
	Poles	[-]	2	2	2
	max. phase voltage, RMS	[V]	160	205	208 (235)
	Rated current	[A]	18	18	18
	Peak current, RMS	[A]	36	36	36
	Shaft Power	[kVA]	4.1	5.5	5.8 (6.8)
Motor option "ultra-precision", 400 V max.	Type	[-]	3 phases, synchronous	3 phases, synchronous	3 phases, synchronous
	Constant torque	[Nm]	0.33	0.33	0.33
	Poles	[-]	2	2	2
	max. phase voltage, RMS	[V]	250	310	380
	Rated current	[A]	5	5	5
	Peak current, RMS	[A]	11	11	11
	Shaft Power	[kVA]	2.1	2.7	3.3
Motor option "ultra-precision", 208 V max.	Type	[-]	3 phases, synchronous	3 phases, synchronous	3 phases, synchronous **)
	Constant torque	[Nm]	0.33	0.33	0.33
	Poles	[-]	2	2	2
	max. phase voltage, RMS	[V]	160	180	208 (220)
	Rated current	[A]	5	5	5
	Peak current, RMS	[A]	11	11	11
	Shaft Power	[kVA]	2.1	2.7	3.0 (3.3)
Rotary encoder	Type	[-]	incremental	incremental	incremental
	Lines	[-]	80	80	80
	Signal A/B	[-]	1 VSS SinCos	1 VSS SinCos	1 VSS SinCos
	Zero flag	[-]	yes (digital/analog)	yes (digital/analog)	yes (digital/analog)
Bearing system	Bearing air supply pressure	[bar]	20 - 30	20 - 30	20 - 30
	Air cleanliness, ISO8573	[-]	3 or better	3 or better	3 or better
	Static radial zero position stiffness at spindle nose	[N/µm]	> 70	> 50	> 35
	Static radial load capacity at spindle nose	[N]	> 900	> 800	> 750
	Static axial zero position stiffness	[N/µm]	> 150	> 120	> 80
	Axial load capacity	[N]	> 1300	> 1200	> 1100
Stability and precision	Taper run-out, TIR	[nm]	< 100	< 100	< 100
	Shaft error in motion	[nm]	< 30	< 30	< 30
	Static tool run-out, TIR	[µm]	< 0.5	< 0.5	< 0.5
	Spindle soak time	[Min]	< 3	< 3	< 3
	Axial shaft growth	[µm]	< 3	< 5	< 7

All values taken at 20 bar bearing supply pressure (gauge pressure)
**) If used with field weakening technology

Levicron GmbH | Sauerwiesen 6
67661 Kaiserslautern,Germany

Phone: +49 (0) 6031 - 66800 - 0 | http://levicron.com | E-mail: info@levicron.com