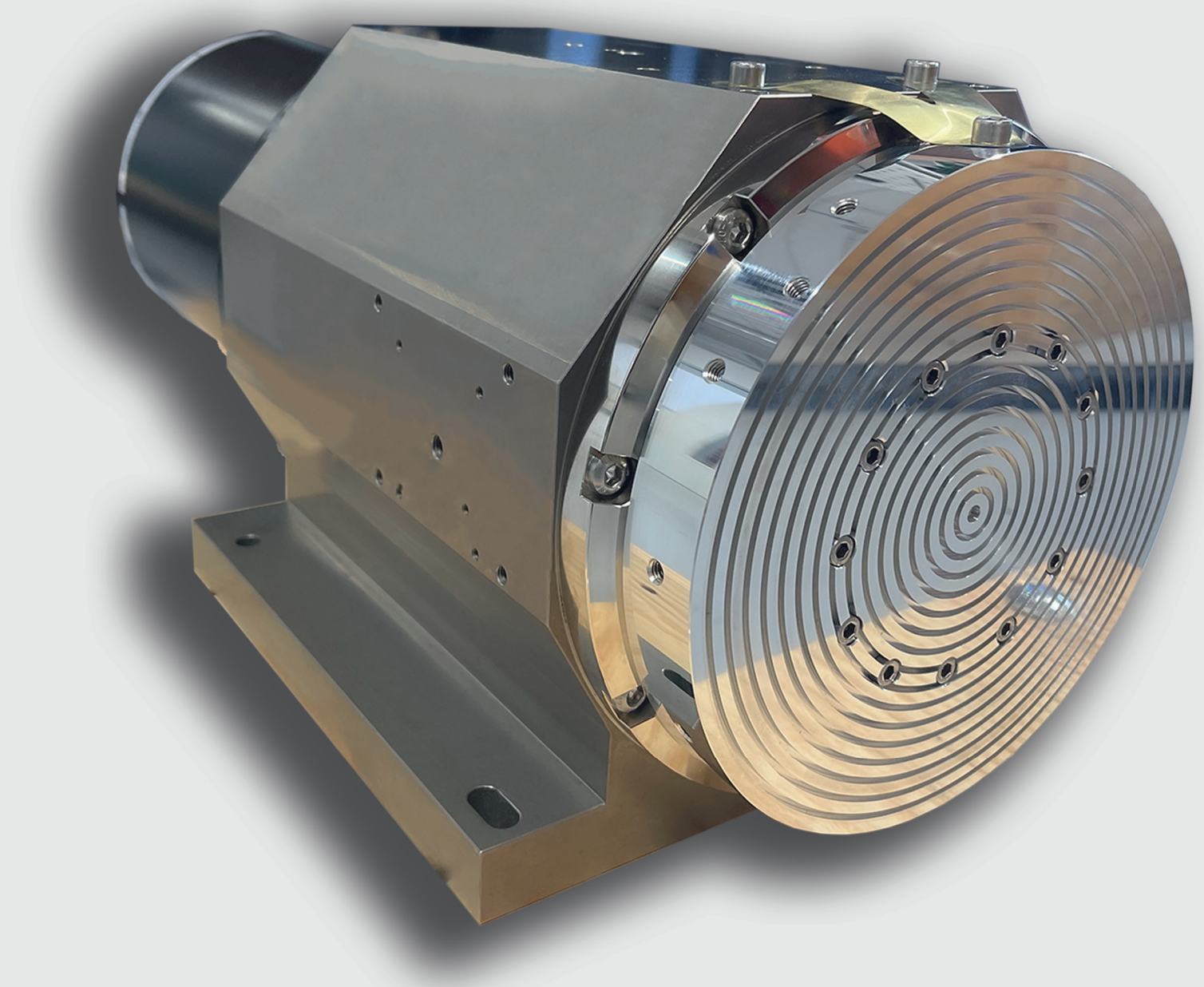
LEVICRON

NON-CONTACT PRECISION MOTION

ASD-Px / ASD-PH63M (Work-holding & positioning / HSK-C63)



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.

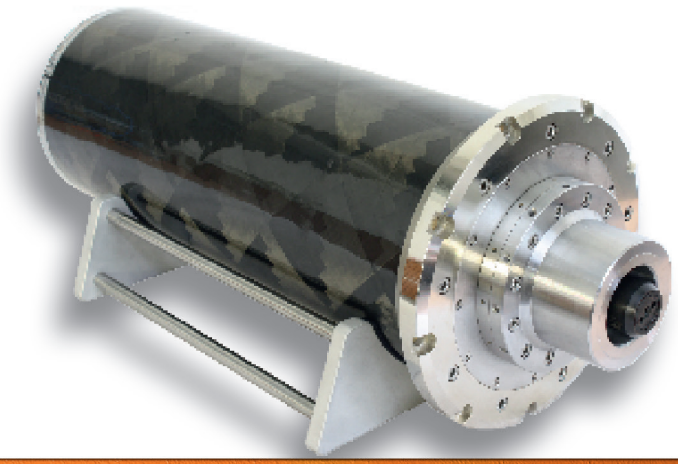
At Levicron, bespoke proven analytical methods and simulation tools for structural analysis and fluid dynamics complement sound practical experience of spindle development and production. Together with the first-ever aerostatic tool spindle comprising an industrial taper interface (HSK) and full CNC 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.

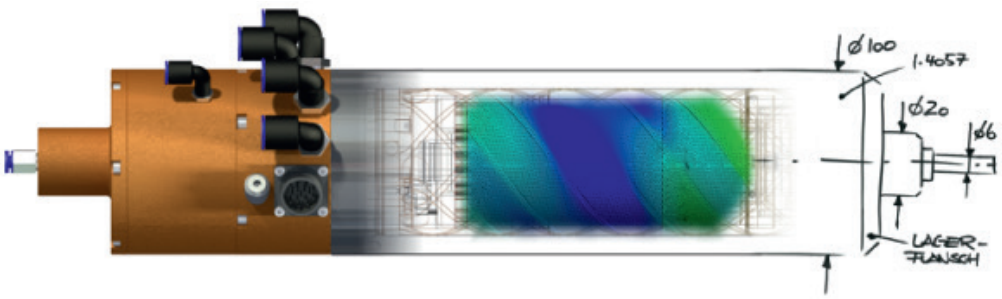
The quality, speed, and accuracy of Levicron spindles and the requirements coming from the applications are used to make it necessary to develop bespoke encoder and motor solutions as well as solutions for HSK tool clamping, HSK tool holding, and others. Because of their unique performance and functionality,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

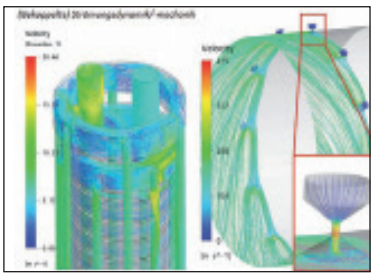
Although Levicron had to reinvent the wheel more than once, our customers can confirm that our wheels run smoother and faster than others. As a result, tool and work-holding spindle solutions for turning, milling, and grinding can provide the customer with unique thermal stability and robustness at shaft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

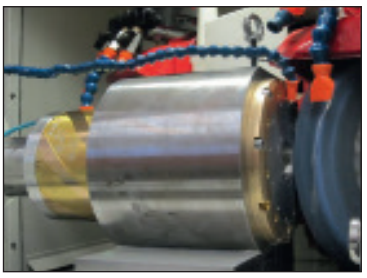


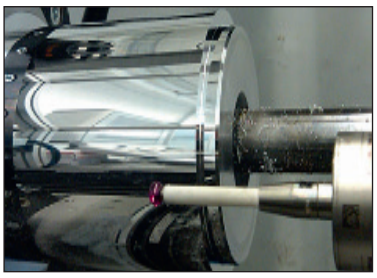
Levicron

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

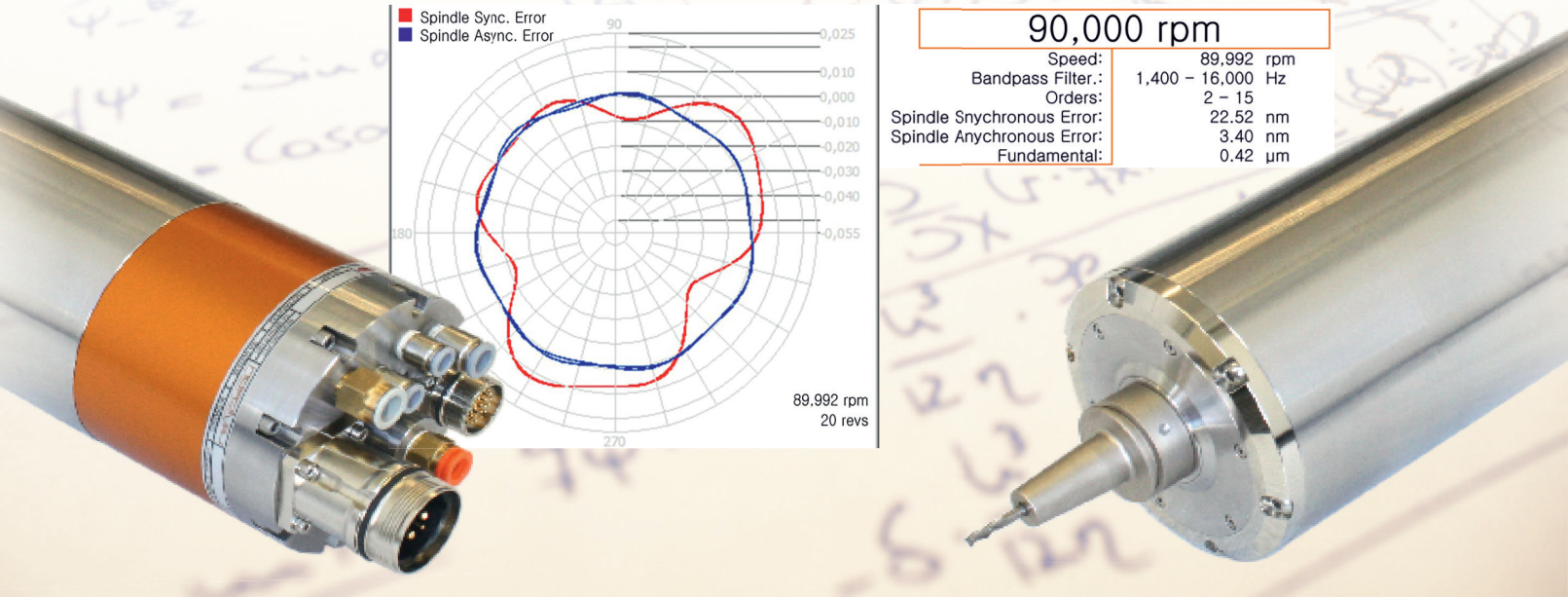
- Higher speeds: speeds of up to 100,000 rpm with HSK-E25 tool holders
- Significantly more minor synchronous and asynchronous spindle errors: dynamic run-out values < 0.5 micron and errors in shaft motion of < 30 nm at any speed
- Thermal stability: spindle soak time < 5 min., axial shaft growth < 5 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

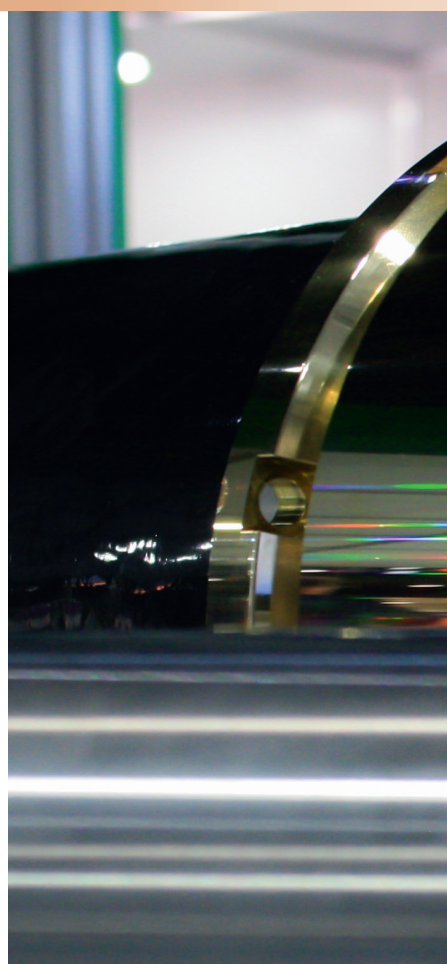
Solutions from Levicron - bespoke solutions to not compromise accuracy and performance:

- Patented bearing technology for outstanding shaft errors in motion, minimized air consumption & 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-Px / ASD-PH63M

Ultra-precision work-holding motor spindle and axis with optional HSK-C63 tool interface.



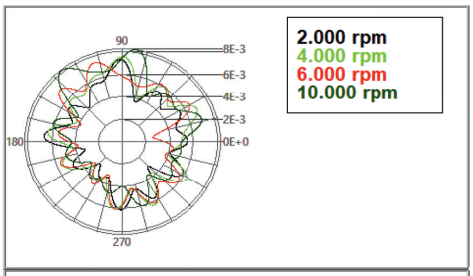
Description

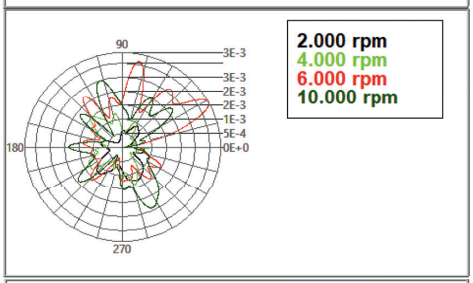
Our **ASD-Px** combines Ultra-Precision with speed and robustness for machining and positioning optics, optical components, or other parts that require Ultra-Precision Machining. It is characterized additionally by a shaft error in motion of under 15 nm, the highest stiffness and load capacity for an aerostatic work-holding spindle.
The high-resolution encoder options and the iron-less motor technology improve performance in slow-tool applications.
A spindle soaks time of under 9 minutes (cold and standstill to 10 rpm), and a thermal shaft growth of fewer than 0.8 microns is achieved by a strictly symmetrical design combined with our efficient thin-film liquid spindle cooling technology.
The cartridge design with axial spindle connectors allows its use in horizontal and vertical machining centers with closed spindle stocks. The “High-Torque” motor option gives 16 Nm motor torque (S1) and provides machining with large grinding wheels.
Grinding large glass lenses with our **ASD-Px** or **ASD-PH63** significantly lowers the subsurface damage and the following polishing process.

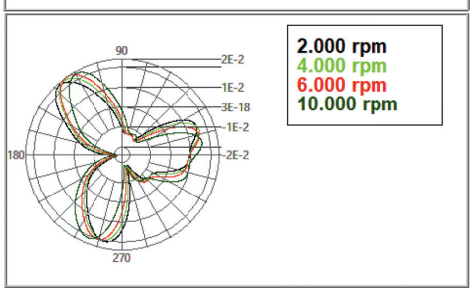
What is the added value?

As a result, the user gets an ultra-precision work-holding spindle for manufacturing and positioning optical components, whether for machining huge metal mirrors at low speeds or lenslet arrays at higher speeds. The optional **HSK-C63** tool interface further allows its use as an ultra-precision tool spindle for grinding applications to create high-precision optics or wafers.

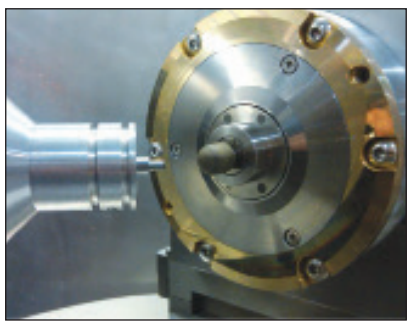
ASD-Px/ PH63M, Multi-probe Error-Motion measurement with error-separation

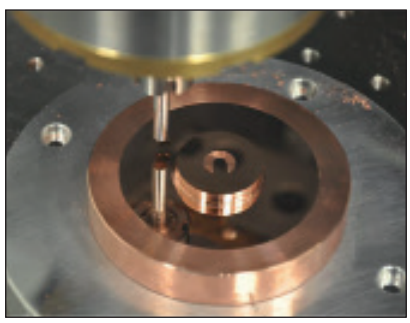






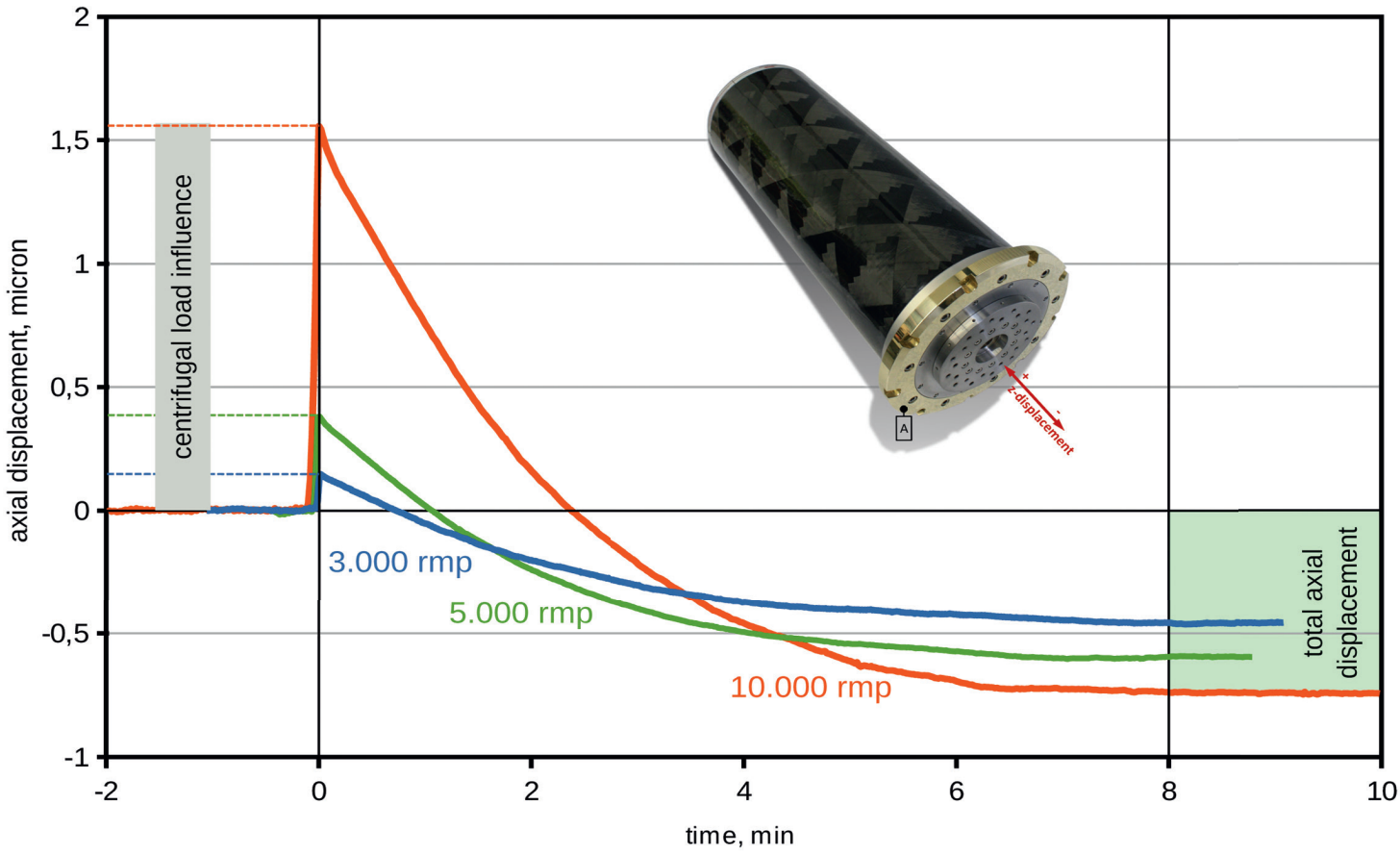
To verify our spindles‘ quality and precision, Levicron has developed its error-motion testing rig, data acquisition, and software.
Multi-probe techniques and capacitive gauges with nanometer resolution at scanning frequencies above 100 kHz allow measurements of synchronous and asynchronous shaft errors in motion at a nanometer level.
Electrical interferences are the most critical influence for asynchronous shaft errors in motion. It separates the spindle error from the target shape error for the synchronous shaft errors in motion.
With Levicron‘s multi-probe technique, all of these errors are reliably measured in one setup to make sure our customers get a spindle quality in the specified range





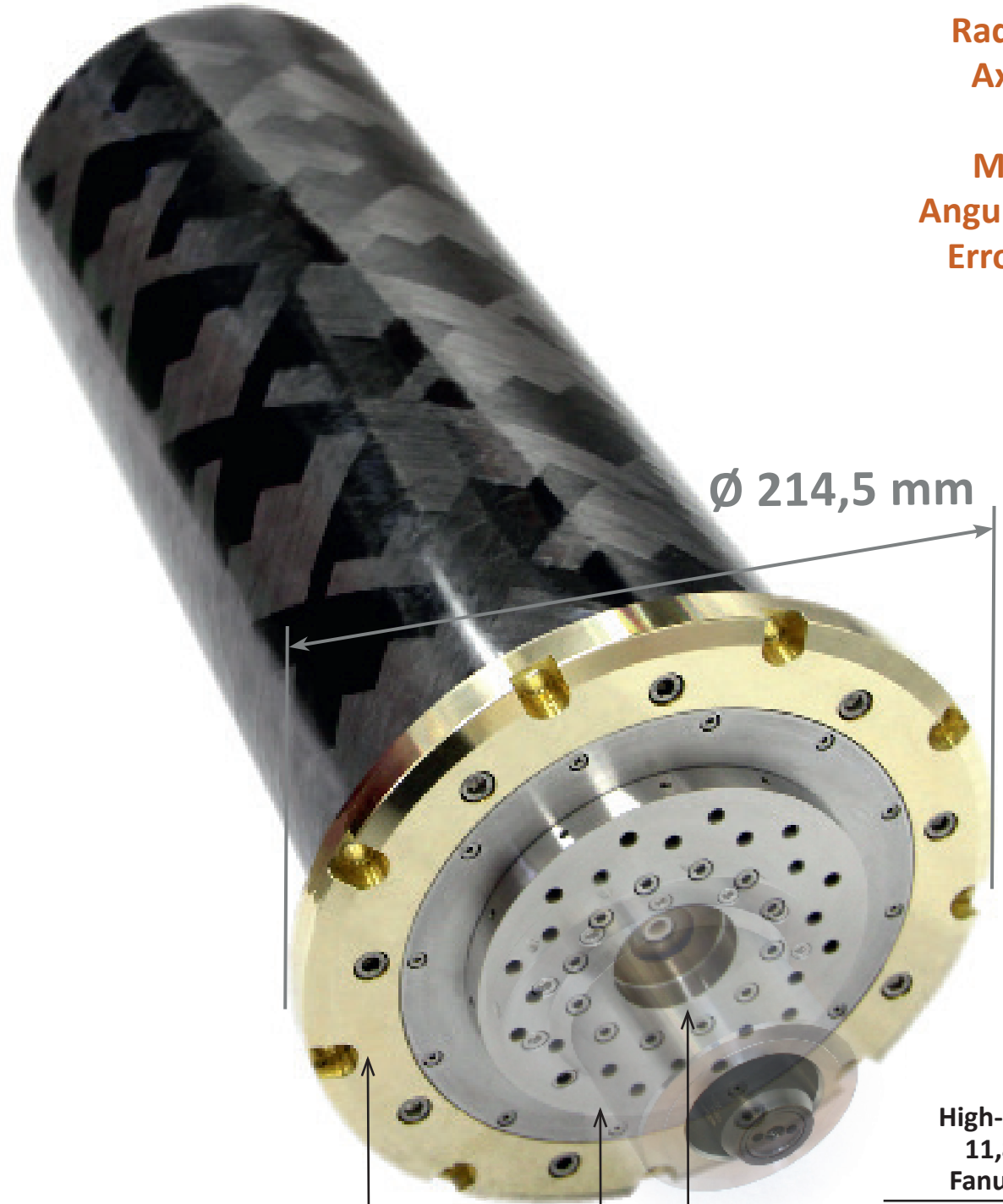
ASD-Px / ASD-PH63M, spindle soak time and, axial shaft growth

The spindle design of the ASD-Px and ASD-PH63M is explicitly aimed at compensating for shaft growth and with Levicron's proven thin-film liquid cooling at exceptionally fast heat-through. The large relative cooling area, combined with high flow rates, thus allows warm-up times of less than 9 minutes from cold and still



At a glance, ASD-Px / ASD-PH63M

Speed:
Radial load capacity:
Radial stiffness:
Axial stiffness:
Motor type:
Motor torque:
Angular accuracy:
Error in motion:



Patented bearing technology

Work-holding options:
- Faceplate
- Vacuum chuck
- Zero-point clamping chuck
- **HSK-C63 (manual)**

Rotary feedthrough vacuum/ air (also co

High-resolution 1 VSS optic
11,840 lines or 26bit BISS
Fanuc, Panasonic comp. ab

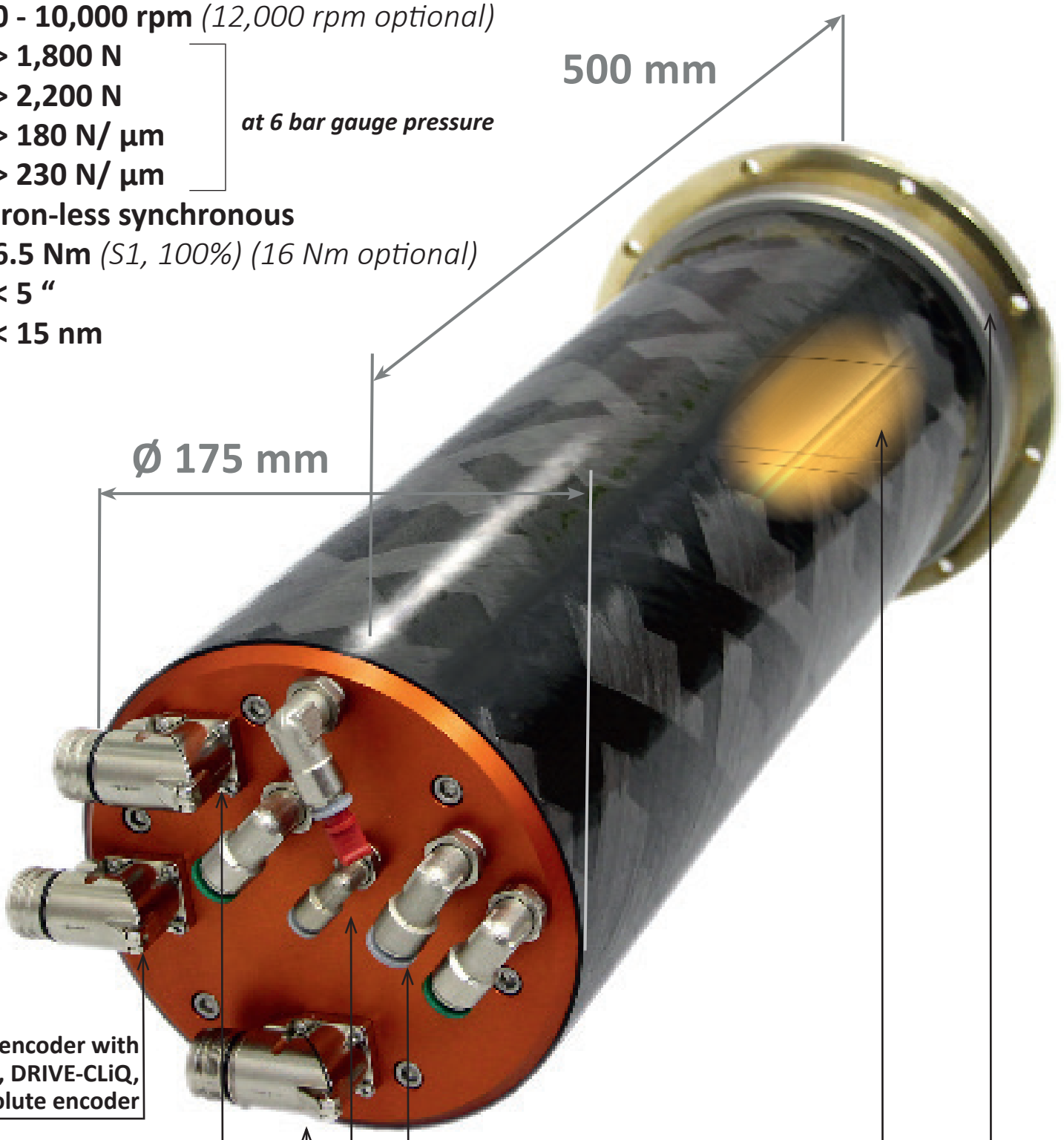
1 VSS GMR

Ultra-low vibratio
techn
optional with

0 - 10,000 rpm *(12,000 rpm optional)*
> 1,800 N
> 2,200 N
> 180 N/ µm
> 230 N/ µm

at 6 bar gauge pressure

Iron-less synchronous
6.5 Nm *(S1, 100%) (16 Nm optional)*
< 5 “
< 15 nm



al encoder with
-C, DRIVE-CLiQ,
bsolute encoder

Encoder with 253 lines

n iron-less synchronous motor
ology with 6.5 Nm torque (S1),
14 Nm (S1) high-torque motor

olant with HSK63 option)

High-efficiency thin-film liquid cooling

Cartridge Design for closed headstocks,
optional with liquid-cooled bolt-on spindle mount

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