

# UTS2



SON (X)  
ultrasonic precision

UTS2  
Made in Germany

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## The Ultrasonic Tooling System

The new 100-kHz Ultrasonic Tooling System UTS2 developed by the company son-x GmbH allows direct ultra-precision machining of stainless steel without geometric constraints and with maximum efficiency. The UTS2 operates with a unique frequency of 100 kHz enhancing cost effectiveness with ultra precision.

This innovative process allows direct machining of steel-, titanium-, nickel-alloys and some glass types in highest quality ( $Ra < 3\text{nm}$ ,  $PV < 150\text{nm}$ ). The typical application is mould insert manufacturing for plastic and glass optics replication.

As a technology leader son-x provides its customers the UTS2 as a machine add-on. Furthermore we offer contract based manufacturing, supplying ultra precise mould inserts and components.



Designed, manufactured and assembled  
in Germany



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## Product description

The UTS2 enables the direct machining of stainless steel and some glass materials with single crystal diamond tools in ultra precise accuracy. The piezo driven ultrasonic transducer generates a linear movement of the diamond tool with a frequency of 100 000 Hz.

Due to its compact design the UTS2 can be integrated into almost any commercially available precision and ultra precision machine. For machines without a vertical axis a micro height adjustment is foreseen. The simple and clear handling of the system based on the "Plug&Play" principle ensures an immediate and efficient use of the technology. The required diamond tools can be purchased at commercial tool vendors and do not have any geometrical constraint.

## Advantages

The primary advantage of the UTS2 is the tool wear reduction when machining steel materials for optical insert manufacturing.

Especially when manufacturing optical inserts directly in hardened steel ...  
... the time consuming and costly nickel-phosphorus plating process is eliminated,  
... the manufacturing time and costs are significantly reduced,  
... the inserts have a longer life time and are scratch resistant,  
... the inserts can be repaired efficiently and without additional coating steps.

The technology makes you as our customer independent from the nickel-phosphorus coating process and it gives you more durable mould inserts for injection moulding. The entire cycle time starting from the optics design up to the replication process is reduced significantly. The shorter production time and the economic benefit give you as our customer a decisive advantage over your competitors.



## TECHNICAL SPECIFICATIONS:

Vibration frequency	100 000 Hz
Vibration amplitude	0,1 - 2 $\mu\text{m}$
Tool holder size W/D/H	79/160/107 (mm)
Generator size W/D/H	365/390/135 (mm)
Tool holder weight	1.2 kg
Tool overhang (geometrical freedom in Z)	40 mm
Height of diamond tip over bottom plate	16 mm
Electrical requirements	110-220 V, <5 A, 50-60 Hz
Electrical power	~200 Watt
Recommended lubrication	Mist coolant
Additional system cooling	not required
Optional	Micro height adjustment or adapter plate
Typical roughness Ra	~3 nm
Typical form accuracy PV	< 200 nm

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## Technology

The UTS2 works with the functional principle of ultrasonic assisted machining. During this process the diamond tool oscillates linearly in cutting direction with a frequency of 100 000 Hz.

The highly frequent oscillation of the tool in cutting direction leads to an intermitted contact between the tool and the machined material. The contact time is around 5  $\mu$ s per cycle and only about 20% of the total processing time.

Several positive effects are realized with the help of this technology, e.g. better cooling of the tool and the interception of chemical wear reactions. Altogether these effects lead to a significant reduction of the diamond tool wear which enables the direct machining of hardened steel.

## Applications

With the UTS2 the ultra precision machining process can be applied on several materials, which could not be machined yet. Several new applications of the technology are given:

- Optical insert manufacturing: The main application of the UTS2 is optical mould inserts manufacturing. Up to freeforms with microstructures can be generated directly in hardened steel. The inserts are applied for injection or glass moulding.
- Optics manufacturing: Some glass materials (BK7 or N-FK5) can be machined, e.g. for prototype manufacturing.
- Medical technologies: Titanium(-alloys), Nickel(-alloys) for sensitive components such as implants.
- Fine mechanics: Precision steel parts for fine mechanics, e.g. watch industry or measurement masters.
- Metal and plastic forming drums: e.g. HSS (HRC 62) and high hardness steel alloys.



## Company Profile

son-x GmbH was founded in the summer of 2011 in Aachen, Germany, as a spin-off company of Fraunhofer IPT. Our vision is to define new standards in ultra precision technology. According to our fundamentals, technology leadership, customer satisfaction and the quality attribute "made in Germany" we offer unique systems in order to push the actual boundaries in optics manufacturing.

The long term experience of son-x' employees in the field of ultra precision machining and optics manufacturing is employed in order to fit the customer's needs..

A strategic partnership with Fraunhofer IPT, one of the most renowned institutes in the field of ultra precision technology, enables our products to be constantly improved. Herewith we ensure absolute state of the art tooling systems setting global technological standards.



## Our Service

### System components

As a technology leader son-x offers its customers tooling systems for ultra precision machining of steel. Furthermore we develop other innovative equipment for mechanical finishing operations.

### Ultra precision manufacturing

Besides the equipment son-x also provides contract based manufacturing. We machine complex ultra precision components on 5-axis state-of-the-art ultra precision machines reaching highest accuracy levels.

With our unique technology we can offer optical mould inserts e.g. for injection moulding in different geometries machined directly in hardened steel:

- spheres
- aspheres
- freeforms
- micro structures
- or a combination

Through our experience in ultra precision machining and our focus on the process technology we offer contract based manufacturing of the most complex manufacturing tasks. We operate selected measurement equipment for part qualification.

**SON**  
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[www.son-x.com](http://www.son-x.com)



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