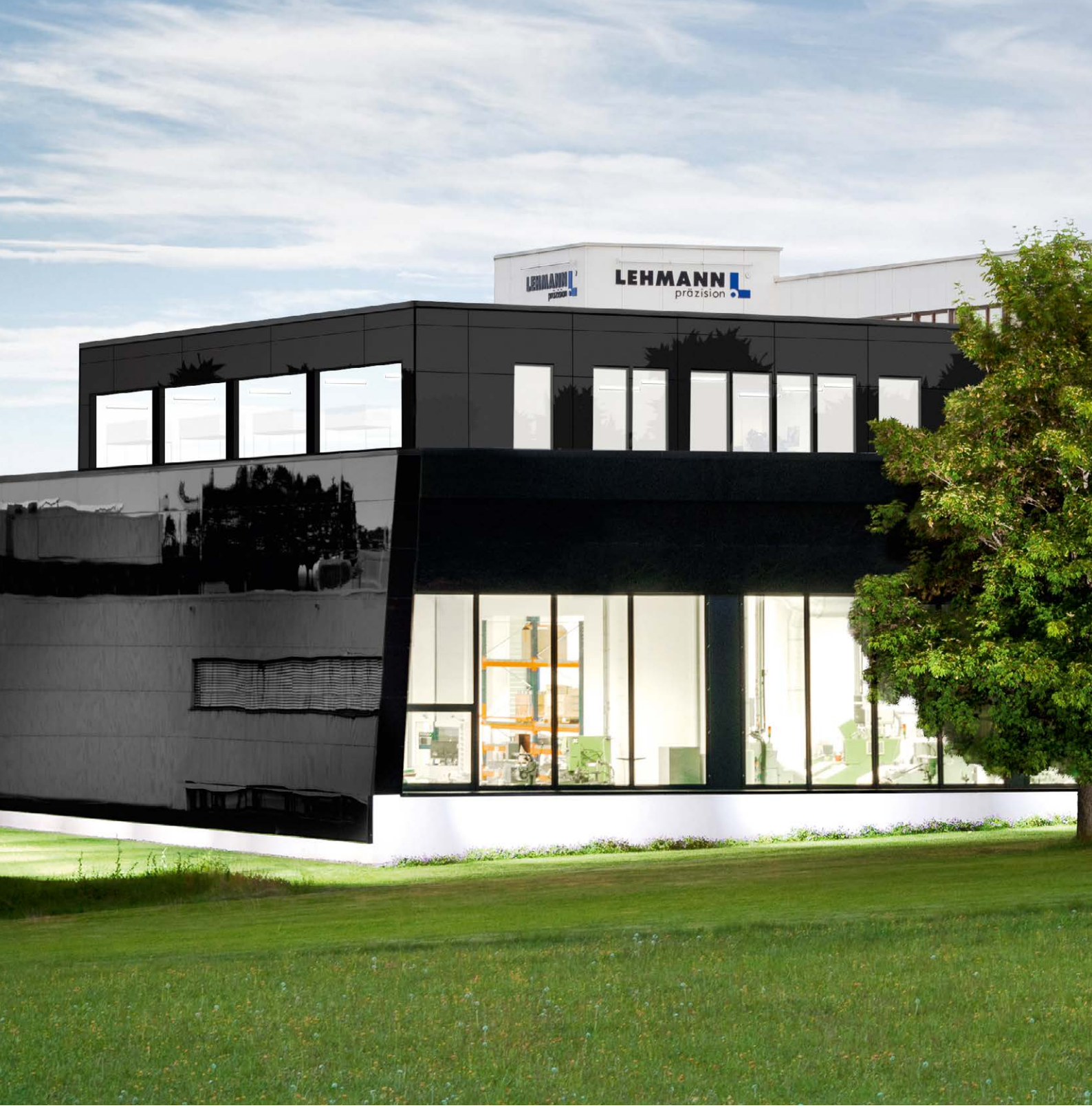
LEHMANN präzision

LINEAR MILLING MACHINES

IN THE BLACK FOREST,
TECHNOLOGY HAS
A LONG TRADITION.



PRECISION IS OUR EXCELLENCE.

Lehmann Präzision GmbH, a manufacturer of precision machinery in the Black Forest, combines traditional and modern technology. The company emerged from a traditional manufacturing enterprise for precision mechanics. This manufacture continues to be an important mainstay. Today, the company is among the leading suppliers of complex precision assemblies for different sectors of industry and of high-precision machine tools. These are used for a variety of applications, amongst others in the watchmaking industry or in the optical industry.

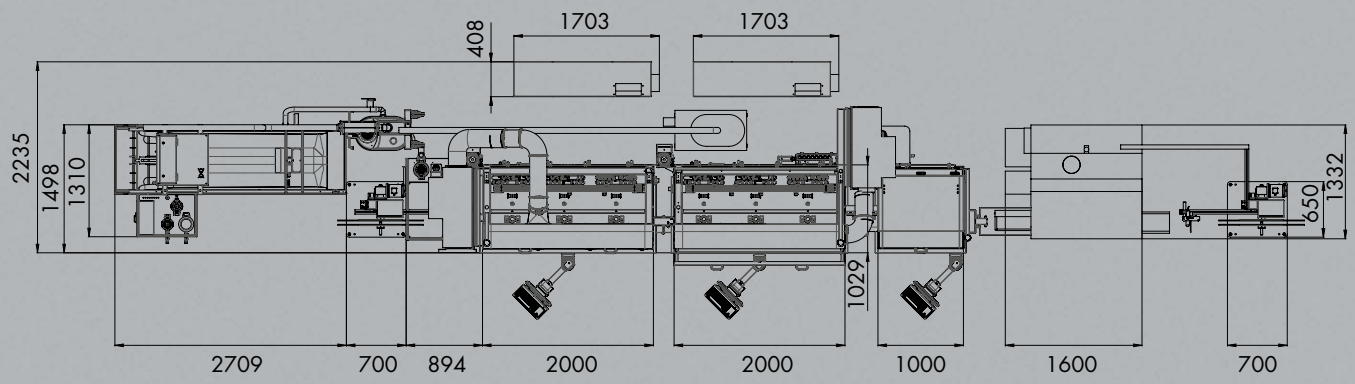
LINEAR MILLING MACHINES

Linear milling machines are used for the machining of precision serial parts directly in the strip. Thanks to several machining stations operating simultaneously, machining an entire workpiece only takes as long as the longest individual operation. If needed, strips can also be machined on both sides in two passes.

The machines are of modular design. In its most simple basic design, a machine for dry machining consists of the following components:

- Decoiler
- Machining module(s), length 2 m, with 3 to 4 machining stations
- Punching unit to punch the finished parts from the strip
- Strip feed
- Cutting unit to shred the strip waste
- Rewinder if machining of parts is to continue in the strip
- Chip extraction

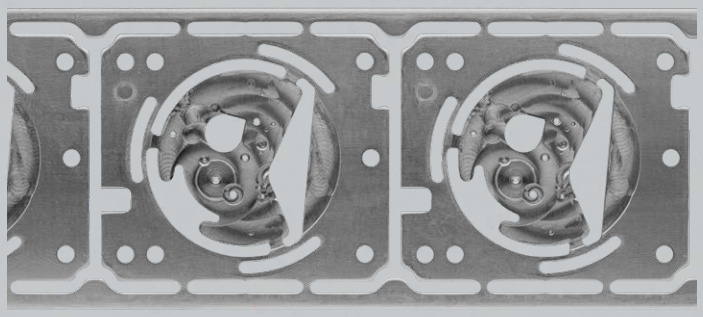
The machines can be further extended with additional options, thus adapting them to any type of application in an optimum way. Both the construction of the machines and the components used are of high quality and thus form the basis for their repeat accuracy and process reliability. The machines are geared to a multiple shifts production and because of the quick and easy retooling are also well suited for the production of small batch sizes.



TECHNICAL DATA

Strip dimensions (typical)	
Width	20 - 50 mm
Thickness	0.2 - 1.5 mm
Pitch	10 - 50 mm
Strip coil outside diameter	500 - 800 mm
Weight	max. 100 kg
3-axes machining stations	
Travel x-axis	40 mm
Travel y-axis	85 mm
Travel z-axis	60 mm
Rapid traverse, linear x-y-z	10 m/min
Acceleration, linear x-y-z	3 m/s^2
Positioning accuracy, linear	±0.001 mm
Position measuring system	absolute, resolution 0.0001 mm
Tool spindles	
Size	HFS 80
Speed	up to 40,000 rpm
Speed control	continuously programmable via CNC
Tool holder	HSK-E 25

MACHINING EXAMPLES



2 m module	
Weight	approx. 3,000 kg
Mains connection	3x 400 V, 3 Ph + N + PE
Compressed air connection	6 bar

FEATURES

MODULAR STRUCTURE

The linear milling machines are designed as modular system, which consists of modules of 2 m or 1 m length with processing stations. There is theoretically no restriction to the number of modules and thus the length of the machine. From a practical point of view, however, the machine length should not exceed 30 m. The modules are extended into a complete, application-specific machine using appropriate additional components.

HARD STONE BASE PLATE

All precision machines by Lehmann are mounted on a substructure of natural hard stone. The massive base plate rests on a sturdy welded frame.

Natural hard stone is absolutely free of distortion, has a low thermal expansion coefficient and excellent vibration damping properties. These properties contribute to the high repeat accuracy of machining operations and lead to an outstanding surface quality of the workpieces.

GUIDES

All axes of the machining stations are equipped with high-precision M- and V-rail guides with needle bearing cages, which are pretensioned backlash-free.

The machine is driven with ball screws and servo motors. A high positioning and repeat accuracy is ensured by absolute position measuring systems with a resolution of 0.0001 mm.

Because of this construction of the axes, it is possible to drive the machine with increased acceleration values and to considerably increase productivity.

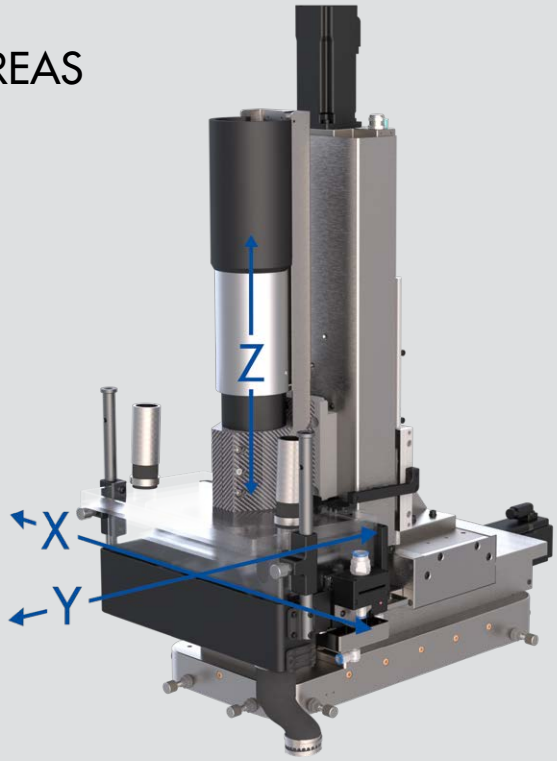
FEATURES

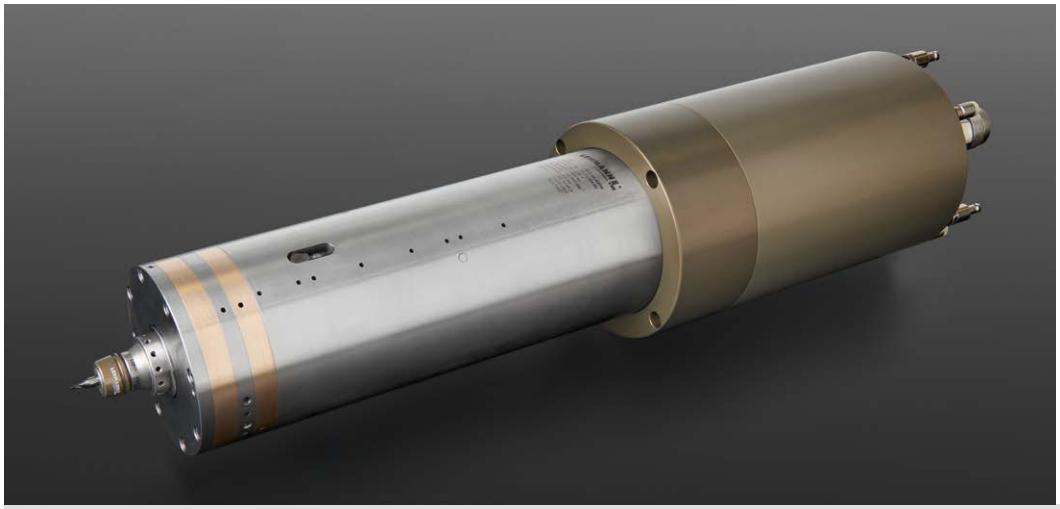
TYPICAL WORK AREAS

X-axis: 40 mm

Y-axis: 85 mm

Z-axis: 60 mm





TOOL SPINDLE

Different spindles that can be selected according to customer requirements can be used in the machines. A selection can be found on pages 12 and 13. The tool spindles are mounted on the Z-axes of the machining stations with a CFRP spindle holder.

The spindles with HSK 25 tool holders offer the following benefits:

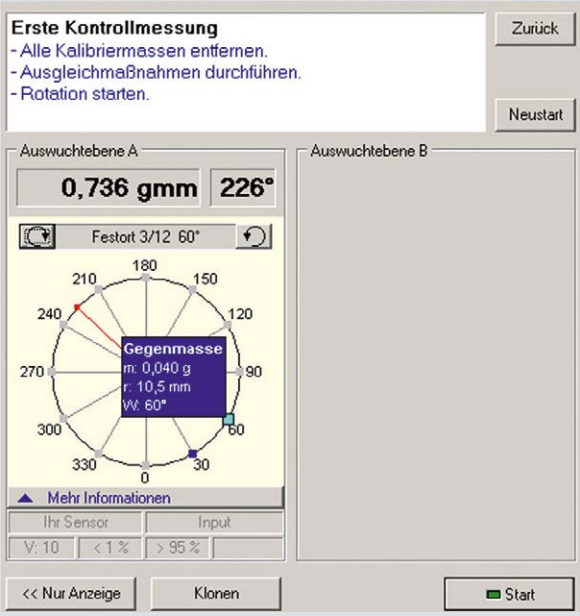
- The shrinkage stress of the tools ensures a tool concentricity under 1 µm.
- Threads for balancing weights are located on the circumference of the holder. This enables the tool holders to be precision balanced with a tool in the spindle (see also page 08).

FEATURES

BALANCING SYSTEM

All air bearing spindles are equipped with integrated vibration and speed sensors. When a corresponding software is used, the spindles can be finely balanced in a quick and easy manner with mounted tool.

The spindles are then running vibration-free, which significantly improves the surface quality and service life of the tools.



The software indicates where balancing weight is required in the HSK tool holder and how much.

The balancing weights are screwed into the HSK tool holder in the form of small stud screws.

FEATURES

CONTROLLER

Each module of the machine is equipped with a modern CNC controller with touchscreen. It has an intuitive, structured menu system with dialogue masks. The program can be secured with a password, allowing the individual machine operators to access the machine via an individually set up electronic key. The CNC programs are created directly on the machine or offline on the PC.

For diagnostic and maintenance purposes, it is possible to intervene with the machine via an authorised remote access.

MAINTENANCE, SERVICE

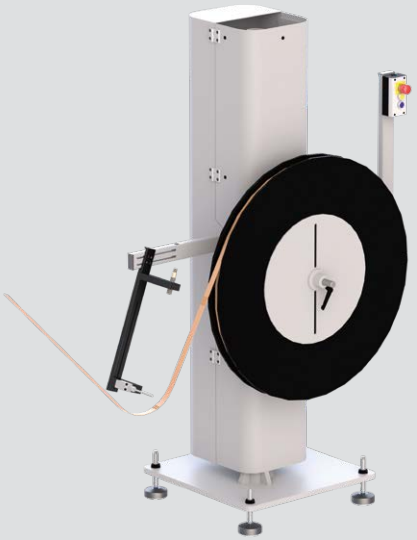
All components that need to be accessible for machine maintenance (pneumatics, etc.) are integrated into the machine in a clearly laid-out and maintenance-friendly manner.

COMPONENTS OF THE MODULAR SYSTEM

DECOILER AND REWINDER

For machining in the strip, the automatic reel is required for uncoiling and rewinding the strips. The coiling or uncoiling process is controlled by a loop control. A light barrier monitors the strip. In the event of strip stretching, the reel is switched off via an emergency stop switch.

As an option, the reel can also be designed to slide on rails.



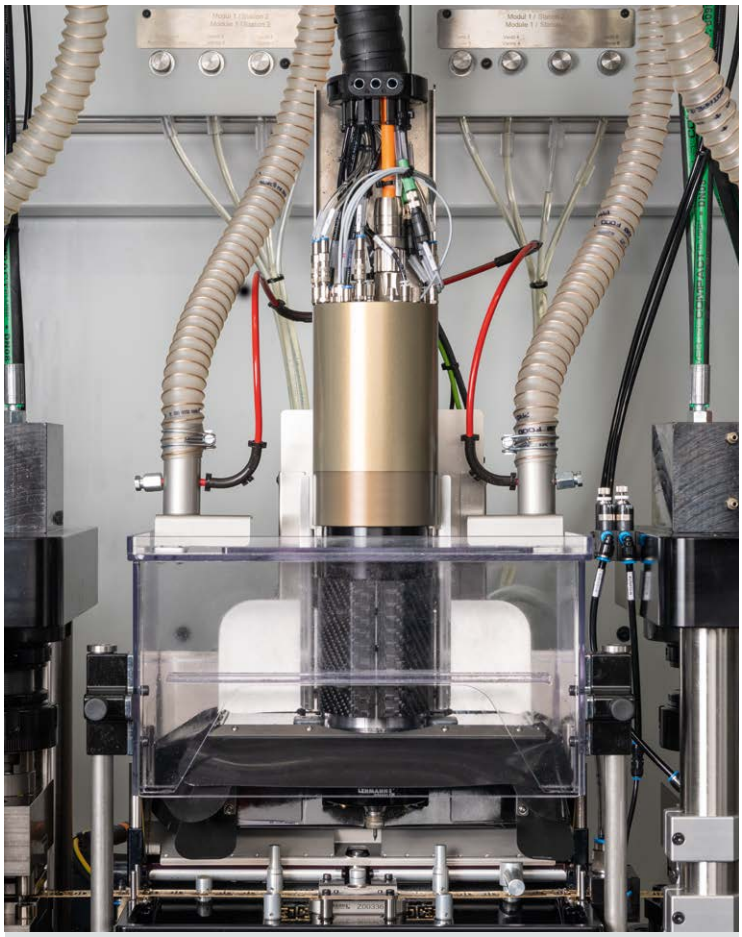
2 m MODULE

A 2 m module has space for three to four machining stations.

1 m MODULE

The 1 m module is mostly installed at the end of the line with a control station and the strip feed.

COMPONENTS OF THE MODULAR SYSTEM



3-AXES MACHINING STATION

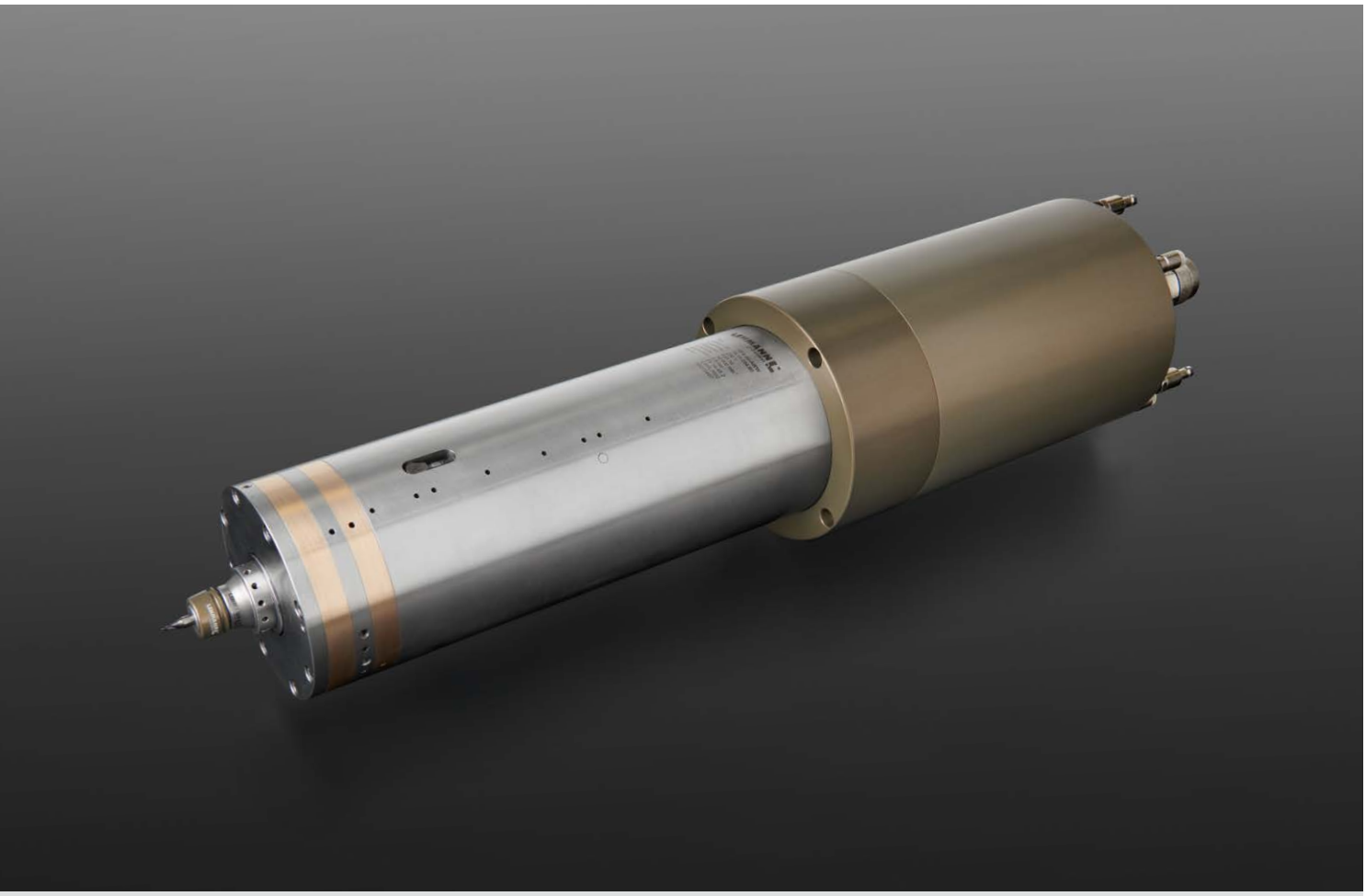
Apart from the CNC-controlled 3-axes system, the tool spindle, a workpiece holding device with pilot pins and strip clamping, a tactile tool length measuring system for tool length measurement, a wear monitor and a tool breakage monitor are installed on the machining station.

The entire station is standing on a solid cast iron plate that is suspended on a film of air while the strip is being positioned in the workpiece holding device. This enables the station to adapt to the strip run and the strip can be indexed without constraint. For machining, the film of air is switched off so that the station is immovably positioned on the hard stone base plate.

1-AXIS MACHINING STATION

This station is used for pure plunging operations. It is similar in design to the 3-axes station. X- and y-axis are designed as sturdy dovetail slide with manual adjustment. The position of the manual axes is shown on a display directly at the station.

COMPONENTS OF THE MODULAR SYSTEM



AIR BEARING TOOL SPINDLE

WITH AUTOMATICALLY ACTUATED TOOL QUICK-CHANGE SYSTEM

The machine is able to achieve best surface qualities and highest tool lives due to the high bearing stiffness, the absolute concentricity and the vibration-free run of the air bearing spindle. The spindle has no bearing friction and is thus wear- and maintenance-free.

The spindle is equipped with the following features:

- HSK 25 or HSK 32 tool clamping system.
- A sealing air barrier that prevents cooling lubricants or dirt from getting into the spindle during operation. This means that air continuously flows from an annular gap between shaft and housing.
- Hollow shank taper cleaning with compressed air during tool change.
- Integrated balancing system for precision balancing the tool in the spindle.
- Clamping and unclamping the tool holder is optionally done with automatically actuated quick tool change system or manually.

COMPONENTS OF THE MODULAR SYSTEM

AIR BEARING TOOL SPINDLE

FOR MANUAL TOOL CHANGE

The spindle is as described on page 12, and the change of the tool holder can be done quickly and easily via manual clamping.

BALL BEARING TOOL SPINDLE

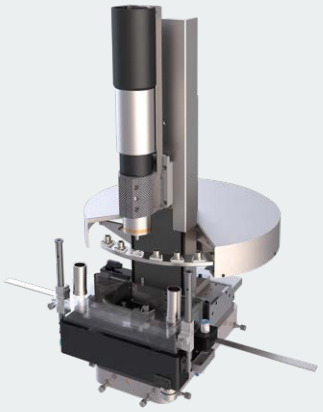
Sturdy ball bearing spindle for rough-machining operations or operations with large and/or unbalanced tools.

MULTI-SPINDLE DRILLING HEAD

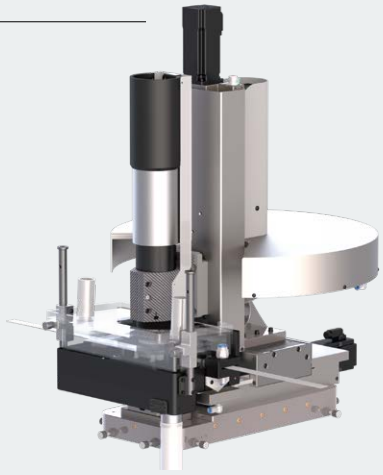
Multi-spindle drilling heads permit the simultaneous machining of several holes in one cycle.

COMPONENTS OF THE MODULAR SYSTEM

Station during tool change



Station during machining



TOOL CHANGER

The tool changer offers the opportunity of automatically changing up to 12 different tools at each machining station. The simple machining station with just one tool is thus turned into a small CNC machine.

This extends the cycle time of the overall machine. This concept is for instance well suited for systems on which pilot productions, process optimisations or small series are run.

In simplified form, the tool changer can also be used to hold stocks for one spare tool per station.

Technical data	
Number of tools	12
Change time	approx. 6 s

PUSH-OUT UNIT

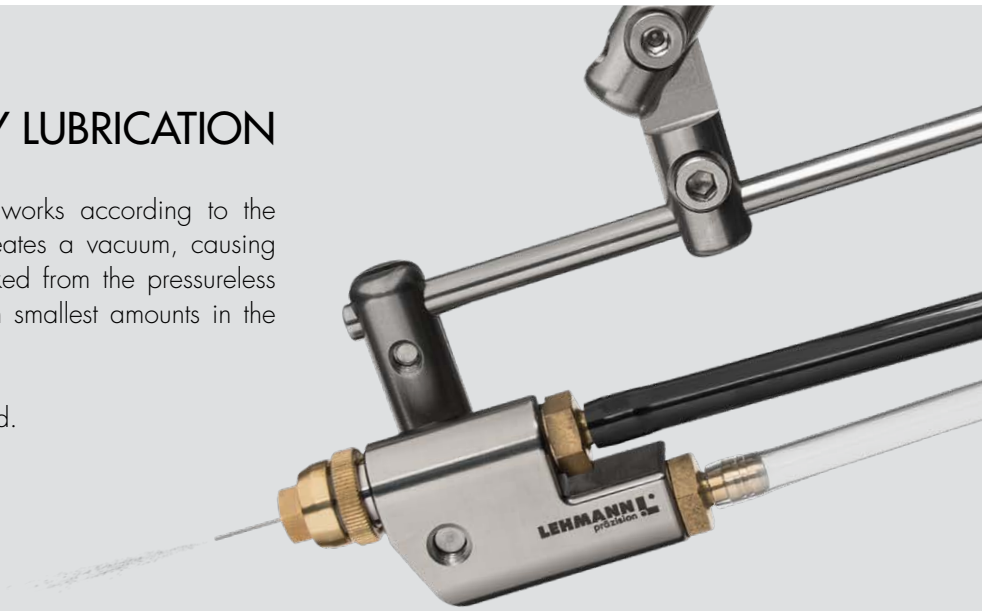
The hydraulic unit to push out test parts is arranged directly downstream of the machining station and permits the immediate removal of parts for testing during set-up.

COMPONENTS OF THE MODULAR SYSTEM

MINIMUM QUANTITY LUBRICATION

The minimum quantity lubrication works according to the Venturi principle. The spray air creates a vacuum, causing the lubricant or coolant to be sucked from the pressureless storage bottle and then sprayed in smallest amounts in the exact position.

Alcohol, oil or emulsion can be used.



STRIP LUBRICATION

Before the strip enters the punching unit, a fine lubrication film must be applied. The lubricant is atomized in a spray chamber by means of a dual fluid nozzle and evenly distributed on the top and bottom side of the strip. Excess lubricant is extracted by suction, filtered and returned to the tank. The oily air is cleaned in a multi-stage filter system.

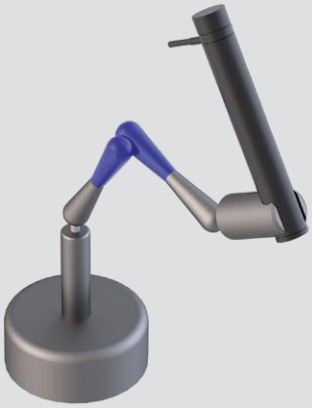
PUNCHING UNIT

The pneumatically, hydro-pneumatically or hydraulically driven punching units with a force of 10 to 100 kN are used for:

- Punching of test parts during setup or in automatic mode.
- Accurate re-punching of pre-milled or pre-drilled holes.
- Punching/pushing out the finished parts.

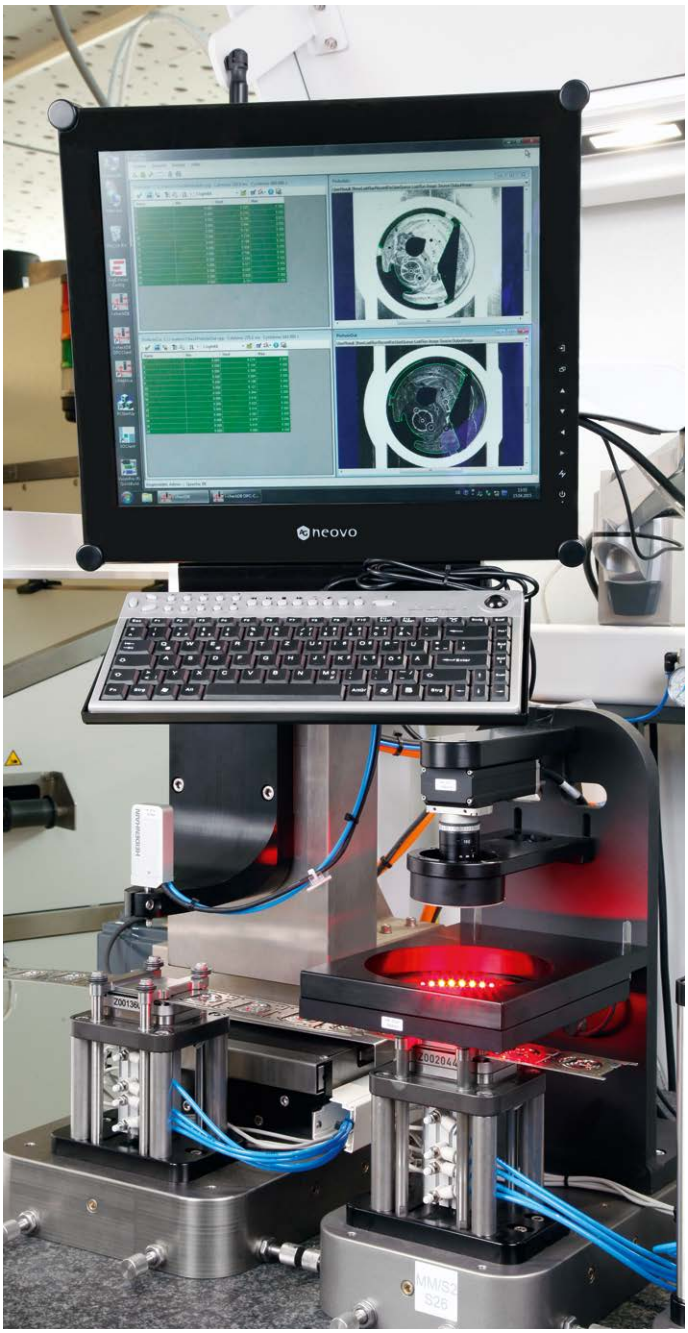
If necessary, an extraction for the punch waste can be provided at the punching unit.

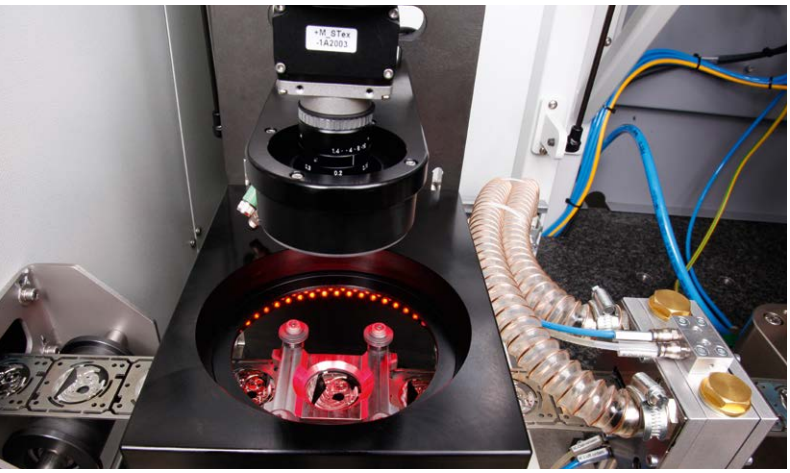
COMPONENTS OF THE MODULAR SYSTEM



MONITORING CAMERA

The mobile microscope camera for visual monitoring can be used at different positions of the machining process in the machine. The image is either shown on the operator screen or on a separate monitor.





MEASURING AND CONTROL STATIONS

Two types of measuring systems are offered for the machines:

- Tactile measuring sensor on a 3-axis station for recording of height measurements.
- Optical camera system for measurements and controls of the x/y level.

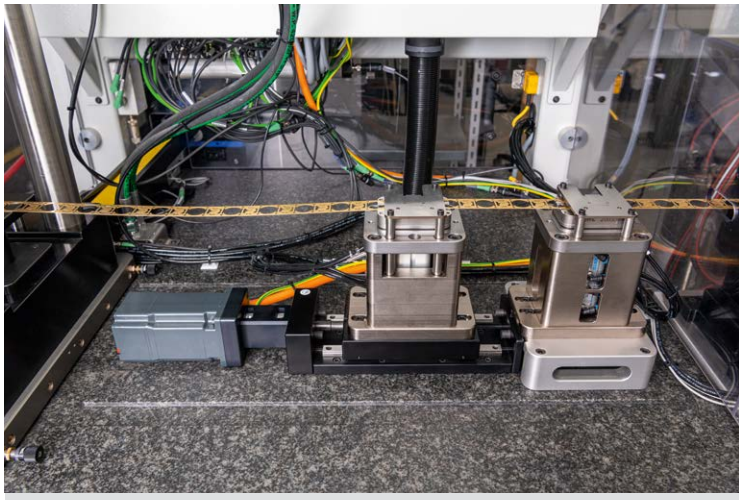
COMPONENTS OF THE MODULAR SYSTEM

SEPARATOR

In the separator, test parts or the finished workpieces that have been punched from the strip can be collected in batches.

Separator for the collection of test parts.

Separator for the collection of finished workpieces.



STRIP FEED

The strip feed is installed at the end of the machine and gradually pulls the strip through the machine in the pilot holes.

It is possible to select equipment with pneumatic drive or servo drive.

CUTTING UNIT

Pneumatic cutting unit that serves to cut the strip waste into pieces at the end of the machine.

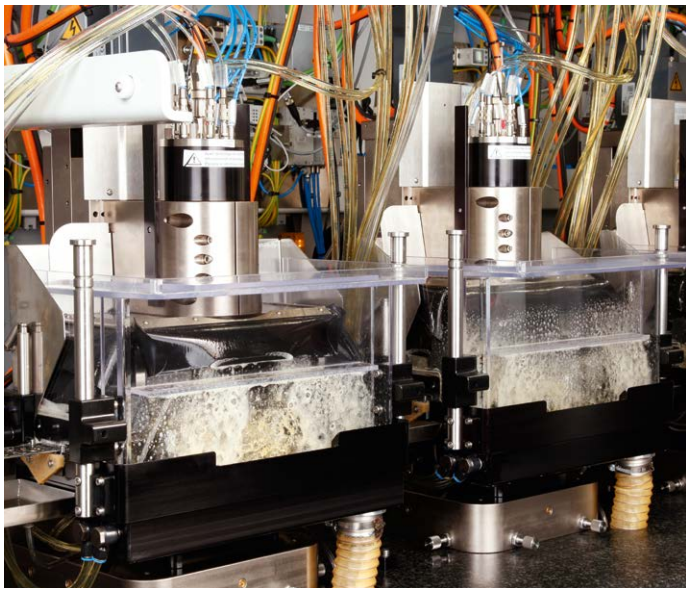
COMPONENTS OF THE MODULAR SYSTEM

CHIP EXTRACTION

In the event of dry machining, the chips are extracted directly at the point of machining by means of a powerful suction device. The device is suitable for continuous operation and can be delivered in an explosion-proof design if required.

MACHINING IN OIL OR EMULSION – OIL BOX

To prevent the entire module being immersed in oil, each machining station is equipped with its own compact oil box. The oil box can be opened to set up the station. During machining, it is closed and hermetically sealed. Different adjustable nozzles wash away the chips from the point of machining and into a discharge channel and flush clean the strip clamping device and the strip before they are conveyed further.

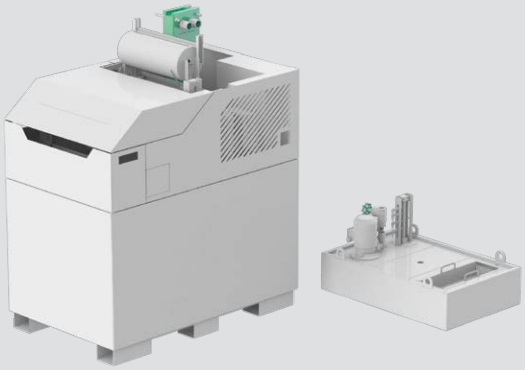


COMPONENTS OF THE MODULAR SYSTEM

BAND FILTERING SYSTEM

The band filtering system is made up of the following components:

- Inlet box for collecting the oil flowing back from the machine.
- Siphon pump to return the oil from the inlet box to the oil reservoir.
- Oil reservoir with band filter. The woven filter medium has been chosen so that even fine chips can be separated.
- Pressure pump for the supply of the machining stations.
- Flushing pump for flushing the return line.
- Plate heat exchanger with circulating pump to control the temperature of the cooling lubricant with an accuracy of ±0.2 °C.



FIRE EXTINGUISHING SYSTEM

The CO_2 fire extinguishing system is able to flood the entire machine room in the event of a fire. Monitoring inside the machine takes place by means of a polymer tube that bursts at an ambient temperature of 110 °C, thus triggering the fire extinguishing system.

The system has a communication interface with evaluation unit and acoustic/visual signal display. The interface is prepared for the transmission of all operating states via a serial interface. The fire extinguishing system requires no external energy for the detection and extinguishing process. In addition, the system is maintenance-free.

OIL MIST EXTRACTOR

The oil mist separator, which is intended for mists and smells of oil or cooling lubricants, has a high separation efficiency and requires little maintenance. All particles >1 µm are separated up to 100 % and returned to the process. All particles <1 µm are separated up to 99.97 % mainly by the disc separation and the additional downstream HEPA filter (H13). The oil mist is extracted directly at the oil boxes to keep the interior of the machine clean.

COMPONENTS OF THE MODULAR SYSTEM

STRIP WASHING MACHINE AND PRECLEANING

The powerful cleaning system with its high pressure cleaning and drying section is suitable for strip material of different width. Cleaning is done with deionised water that is treated in a machine-internal circuit. Drying is done with hot air.

The device can be equipped with different options:

- Separate precleaning system that is supplied from the strip washing machine.
- Integrated strip feed with loop control.
- Cleaning additive dosage
- Condenser attachment
- Water treatment

STRIP WELDING MACHINE

This is a semi-automatic machine for the seamlesss welding together of two pieces of strip for a fast and easy change of material. In case of a coil change, the beginning of the new strip can be welded to the end of the old strip. This omits having to empty the machine and subsequently thread a new strip.

The welded connection is established with a high indexing accuracy. The weld is smoothed by an integrated pressing device so that it does not impede the passage of the strip through the machine.

An electrode grinding device can be supplied as accessory.

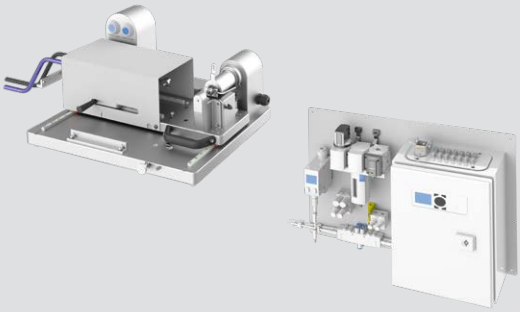
COMPONENTS OF THE MODULAR SYSTEM

HOT AIR SHRINK FIT DEVICE

The shrinkage stress applied in the high speed spindles provides for an excellent concentricity of the tools and high repeat accuracy during a tool change. The hot air shrink fit device is an auxiliary device that makes it possible to change tools quickly and easily directly in the machine. As it is a mobile device it can be used at different machines as needed. The device consists of an ergonomic heat handle and a control unit.

SHRINK-FITTING STATION

The benchtop workstation is equipped with a hot air shrink fit device to change the tools in HSK holders with shrink-fitting system. Electrical cabinet and pneumatic components are mounted on a mounting plate that can be fastened on the bench.



BALANCING STATION

Complete workstation for the efficient preparation of the tools outside the machine.

The workstation consists of:

- Hot air shrink fit device for changing the tools in HSK holders with shrink-fitting system.
- Balancing spindle with software for precision balancing the HSK holders with mounted tools.

DESIGN EXAMPLES

Modular machine for machining the first side of watch parts in oil.

Technical data	
Number of modules	6
Number of 3-axes stations	20
Number of 1-axis stations	3
Number of CNC-axes	68
Length	22 m

Equipment

- 2 NC strip feeds (1x pushing, 1x pulling)
- Monitoring camera on each machining module
- 10 kN punching unit for punching waste pieces
- Height measuring station
- Marking of faulty parts
- Strip washing machine with precleaning
- Strip welding machine
- Shrink-fitting station

Modular machine for machining watch parts in oil. Subsequent operation for the machine shown above, during which the second side of the strip is machined.

Technical data	
Number of modules	5
Number of 3-axes stations	16
Number of 1-axis stations	3
Number of CNC-axes	56
Length	20 m

Equipment

- 2 NC strip feeds (1x pushing, 1x pulling)
- Monitoring camera on each machining module
- Visual check before and after punching
- 100 kN punching unit for re-punching drilled holes
- Height measuring station
- Marking of faulty parts
- Strip washing machine with precleaning
- Strip welding machine
- Shrink-fitting station

DESIGN EXAMPLES

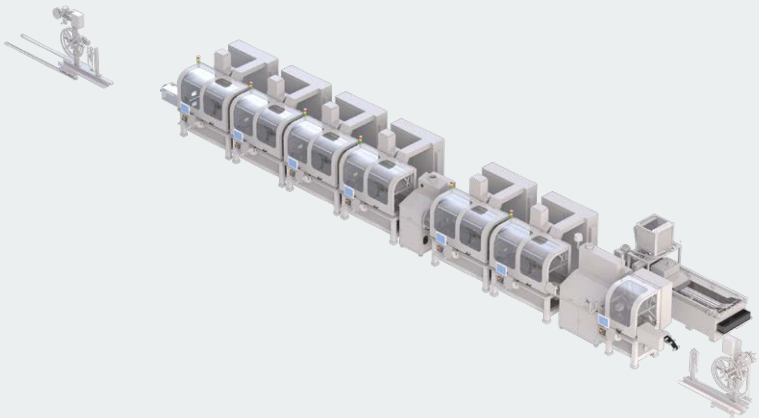
Modular machine for machining watch parts in oil. Subsequent operation for the machine at the bottom of page 22, where machining of the first side of the strip is finished.

Technical data	
Number of modules	3
Number of 3-axes stations	12
Number of CNC-axes	41
Length	23 m

Equipment

- 2 NC strip feeds (1x pushing, 1x pulling)
- Monitoring camera on each machining module
- Height measuring station
- Marking of faulty parts
- Strip washing machine with precleaning
- Sandblasting system
- Strip welding machine
- Shrink-fitting station

Modular machine for machining the first side of watch parts in oil.



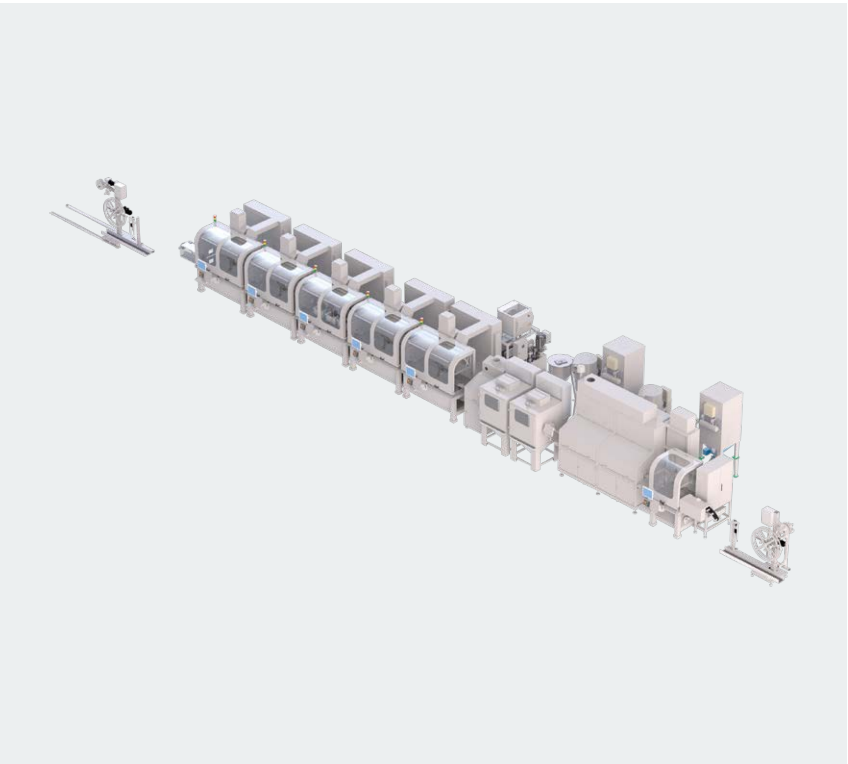
Technical data	
Number of modules	6
Number of 3-axes stations	22
Number of 1-axis stations	1
Number of CNC-axes	72
Length	22 m

Equipment

- 2 NC strip feeds (1x pushing, 1x pulling)
- Monitoring camera on each machining module
- Height measuring station
- Marking of faulty parts
- Strip washing machine with precleaning
- Strip welding machine
- Shrink-fitting station

DESIGN EXAMPLES

Modular machine for machining watch parts in oil. Subsequent operation for the machine at the bottom of page 23, where the second side of the strip is machined.



Technical data	
Number of modules	5
Number of 3-axes stations	19
Number of 1-axis stations	1
Number of CNC-axes	63
Length	25 m

Equipment

- 2 NC strip feeds (1x pushing, 1x pulling)
- Monitoring camera on each machining module
- Visual check before and after punching
- 100 kN punching unit for re-punching drilled holes
- Height measuring station
- Marking of faulty parts
- Strip washing machine
- Sandblasting system
- Strip welding machine
- Shrink-fitting station

Modular machine for machining watch parts in oil. The strip is machined in two passes on both sides.

Technical data	
Number of modules	2
Number of 3-axes stations	6
Number of CNC-axes	21
Length	15 m

Equipment

- Spindles with automatically actuated quick tool change system
- 10 kN punching units after each machining station for punching of test parts or for punching the finished parts after the last machining station
- Separators for collecting test and finished parts
- NC strip feed
- Strip washing machine

DESIGN EXAMPLES

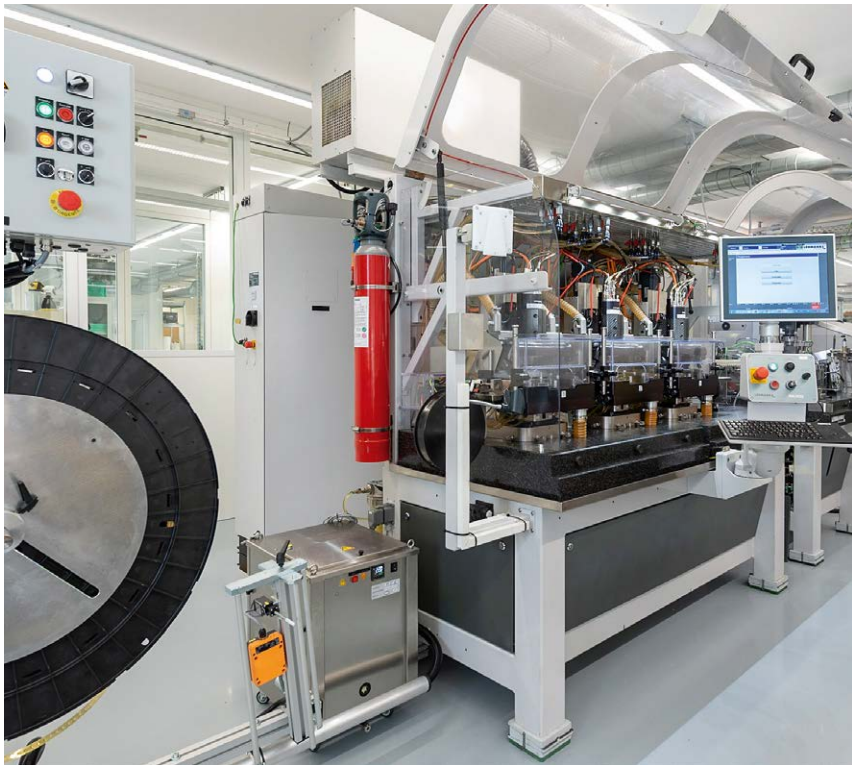
Modular machine for machining watch parts in oil. The strip is machined in two passes on both sides.

Technical data	
Number of modules	2
Number of 3-axes stations	6
Number of CNC-axes	20
Length	12 m

Equipment

- Spindles with automatically actuated quick tool change system
- 10 kN punching units after each machining station for punching test parts or for punching the finished parts after the last machining station
- Separator for collecting the finished parts
- NC strip feed
- Strip washing machine
- Balancing station

Modular machine for machining watch parts in oil. The strip is machined in two passes on both sides. The second module with the punching unit was subsequently installed in the machine.



Technical data	
Number of modules	2
Number of 3-axes stations	3
Number of CNC-axes	9
Length	10 m

Equipment

- 60 kN punching unit for punching the finished parts on module 2
- Separator for collecting the finished parts
- Strip washing machine

DESIGN EXAMPLES

Modular machine for machining watch parts in oil. The strip is machined in two passes on both sides.

Technical data	
Number of modules	2
Number of 3-axes stations	6
Number of CNC-axes	19
Length	11 m

Equipment

- Minimum quantity lubrication in addition to cooling lubrication with oil
- 30 kN punching unit for punching the finished parts
- Separator for collecting the finished parts
- Strip washing machine with precleaning

Machine for dry machining watch parts. The strip is conveyed through the machine upright.

Technical data	
Number of CNC-axes	30
Number of high speed spindles	36
Length	12 m

DESIGN EXAMPLES

Machine for dry machining watch parts.

Technical data	
Number of 3-axes stations	12
Number of CNC-axes	36
Length	12 m

Machine for dry machining watch parts.

Technical data	
Number of 1-axis stations	4
Number of CNC-axes	9
Length	4.5 m

Equipment

- Minimum quantity lubrication
- Chip extraction
- 20 kN punching unit
- NC riveting module
- Palletizer
- Cutting unit

DESIGN EXAMPLES

Machine for dry machining watch parts.

Technical data	
Number of 3-axes stations	1
Number of 1-axis stations	3
Number of CNC-axes	8
Length	4.5 m

Equipment

- Minimum quantity lubrication
- Chip extraction
- 20 kN punching unit
- Pneumatic riveting station
- Palletizer
- Cutting unit

Machine for dry machining watch parts. The strip is machined in two passes on both sides.

Technical data	
Number of 3-axes stations	6
Number of CNC-axes	19
Number of CNC-axes	10 m

Equipment

- Minimum quantity lubrication
- Chip extraction
- Monitoring camera
- 30 kN punching unit for punching the finished parts
- Separator for collecting the finished parts
- Cutting unit
- Strip washing machine

DESIGN EXAMPLES

Machine for dry machining watch parts. The strip is machined in two passes on both sides.

Technical data	
Number of modules	2
Number of CNC-axes	7
Length	5.5 m

Equipment

- Minimum quantity lubrication
- Chip extraction
- Monitoring camera
- 30 kN punching unit for punching the finished parts
- Separator for collecting the finished parts
- Cutting unit

Test module for trials and process optimisation, for machining in oil.

Technical data	
Number of 3-axes stations	1
Number of CNC-axes	3

Equipment

- Cleaning station

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