LASER LINE ULTRA

State-of-the-art ultra-short pulse laser technology for maximum flexibility

Key parameters

The LASER LINE ULTRA carefully machines all commercially available cutting materials such as carbide, CBN, ceramic, PCD, CVD-D and MCD without producing heat, thus producing exceptional surface quality. It has a possible clamping range of 200 mm in diameter and up to 250 mm in length, making it very versatile in its field and the first choice when a great deal of flexibility is required in applications.
The origins of EWAG date back to 1946 when the company manufactured precision tool grinding machines for the Swiss watch industry. Today the EWAG product range includes a CNC tool grinding machine for grinding inserts as well as laser machines for indexable cutting inserts and rotationally symmetrical tools made from hard and ultrahard materials such as carbide CBN or PCD.

EWAG belongs to the UNITED GRINDING Group. Together with our sister company, Walter Maschinenbau GmbH, we consider ourselves to be a supplier of systems and solutions for the complete machining of tools and can offer a wide range of products, including grinding, rotary eroding, laser machining, measurement and software.

Our customer focus and our global sales and service network of company owned locations and employees has been appreciated by our customers for decades.
The LASER LINE ULTRA is one of the leading technological high-end laser machining units for demanding applications. It has state-of-the-art ultra-short pulse laser technology, ensuring all cutting materials are machined carefully to produce exceptional quality. The EWAG Laser Touch Machining® Process (LTM®) achieves highly complex geometries with exceptional surface quality – in just one clamping operation. The LASER LINE ULTRA offers a great deal of flexibility thanks to its kinematics, flexible programming, ultra-short pulse laser technology and integrated automation.
LASER LINE ULTRA at a glance

**Application**
- All-in-one machining of blades, cavities and chip grooves followed by labelling in one clamping operation
- 3D machining of all commercially available cutting materials
- Ultimate surface quality for long service lives
- Indexable inserts from 3 mm inside diameter and up to 50 mm circumscribed diameter
- Holds rotationally symmetrical tools of 0.5 to 200 mm in diameter and of up to 250 mm in length
- Materials HM, cermet, ceramic, CBN, PCD, CVD-D, MCD/ND

**The machine**
- Ultra-short pulse laser with picosecond pulses
- Low-vibration cast-iron machine bed
- 5-axis CNC tool machine plus overlaid 3-axis laser beam guide
- Direct drives in the linear axes
- Torque motors for B and C axes
- Automatic HSK 63 interface
- Shielded machining room for laser protection class 1
- Beam guide in protective atmosphere
- Integrated laser output measurement and monitoring (IPC)
- Automatic focus position detection
- Automatic calibration of CNC/optical axes
- Integrated 3D measuring probe
- FANUC control unit, the global standard
- Automation peripheral equipment includes FANUC 6-axis robot

LASER LINE ULTRA – by implementing ultra-short pulse laser technology with a pulse duration of 10 picoseconds, all commercially available materials, in particular cutting materials such as CVD-D or MCD, can be machined.
Software

- EWAG LaserSoft combines laser and machine control
- Direct 3D CAD/CAM interface
- Fastest programming starting with the shell contour (e.g. DXF)
- Simplest definition of laser removal paths
- Various User Levels available
- Simple program structure using standardized modules
- Management of laser status, hardware, tools, production and order processing

Ultra-short pulse laser with direct vaporisation without heat input maintains material properties

The ultra-short pulse laser works with direct vaporisation without any significant heat input thanks to laser pulses of 10 picoseconds (cold ablation). The tool is therefore not subjected to thermal damage during erosion, which significantly increases its service life. Furthermore, the ultra-short pulses in combination with high repeat rates generate high-quality surfaces.

Thanks to the unique 8-axis kinematics concept, the LASER LINE ULTRA machines highly complex geometries in just one clamping operation. The 6-axis robot guarantees ultimate productivity during minimally manned multi-shift operation. LASER LINE ULTRA and robots are coordinated via FANUC control technology.

EWAG Laser Touch Machining®

Tangential laser beam machining generates top-quality cutting edges and cutting geometries in an efficient manner. In this process, the surface is shaped with the outer surface of the laser beams. The cutting groove is produced by the repetitive hatching pattern of the laser scanning unit and by the simultaneous travel movement of the CNC axes. This unique, patented machining technology is marketed under the brand EWAG Laser Touch Machining® (LTM®).

1. 2D scanning unit; moves the beam in the X/Y plane
2. Laser beam
3. Repeating 2D pattern
4. Workpiece movement via 5-axis CNC (X/Y/Z/B/C)
5. Machined erosion paths
6. Final geometry/free surface
Ultimate surface quality for all materials
Conventional machining  
Material ILJIN CXL-II  
2 µm – 40 µm mixed grain

Laser machining  
Material ILJIN CXL-II  
2 µm – 40 µm mixed grain

Concave blade  
Material ILJIN CXL-II  
2 µm – 40 µm mixed grain

Excellent cutting quality
The effortless erosion process with the picosecond laser prevents cracks on the blade – unlike in conventional procedures. It also enables a higher level of flexibility; for instance, concave cutting cycles are possible. 3D machining of diamond or carbide allows tools to be manufactured that have advanced functionality. Moreover, the cutting material can be selected as required. State-of-the-art CVD-D tools, with which very popular materials like carbon-fibre composites or aluminium alloys are currently being machined, can be produced with outstanding results on the LASER LINE ULTRA.
Kinematics and laser pulses shape each geometry

- High removal rates
- Ultimate surface quality
- Distinguished kinematics

**High-end laser source**
The picosecond laser achieves ultimate erosion performance and surface quality, while causing almost no thermal damage to the workpiece.

**Stable beam environment**
The beam guide ensures ultimate process stability and constant beam properties. The beam path is fully encapsulated and is guided into a protective atmosphere under excess pressure. The deflection mirrors are monitored and sensitive optical components are integrated into the cooling circuit.

**Distinguished machine concept**
The intelligent kinematics concept with 5 CNC axes and one overlaid 3-axis laser beam guide guarantees the highest possible levels of flexibility when machining highly complex tools.
• Low-maintenance linear drives
• HSK 63 tool interface
• 3D measuring probe
• Automatic calibration of CNC/optical axes, laser output and focus position

**HSK 63 interface**
The highly accurate tool holder is decisive for a precise machining result and it is compatible with a wide range of clamping devices on the market.

**Clamping indexable inserts**
Indexable inserts can be clamped with a clamping station or using a nail clamp.

**Automation of cylindrical workpieces**
The double gripper of the robot automatically feeds the cylindrical workpieces, e.g. drills and milling cutters, from pallets.

**Automatic calibration**
The machine calibrates itself for highly accurate machining. Both the 5 CNC axes and the 2 optical axes of the deflection system as well as the laser output and the focus position are measured exactly in an automatic process.

**3D measurements**
Soldering errors are detected via an integrated 3D measuring probe and the plate position is automatically compensated in LaserSoft, the laser software from EWAG. The exact plate height is also detected in order to accurately readjust the focus position.
Flexible automation

Robot integration
The efficient EWAG rotating drum solution for integration of a FANUC 6-axis folding-arm robot with various gripper systems enables automatic multi-shift operation. Laser machining cells and robot cells have a beam-proof design and are integrated to save space. Transformer substations and automatic part detection also support automatic operation.

Customer-specific tool handling
Tool handling in the LASER LINE ULTRA is tailored precisely to customer requirements: indexable inserts can be clamped automatically in series or in alternating series. Rotating tools can be loaded automatically via HSK 63 tool holders or via the double gripper head. Rack and pallet systems, including automatic pallet stacker solutions, are available.

Triple gripper
In order to reduce change times to a minimum, indexable inserts are inserted using a triple gripper head on the FANUC robot. The robot detects the tool and the allocated clamping system; the gripper takes the tool from the pallet and transfers it to the clamping station in the correct, precise machining position.

- Space-saving robot integration
- Customer-specific tool handling
- Profitability, even for small batch sizes

Flexible automation
How to get optimum use out of the LASER LINE ULTRA

In order to get optimum use out of your laser processing machine we offer a customised training session. At the end of the training session you are given a certificate showing the training has been successfully completed. This provides you with evidence of the solid practical training your employees have received.

The training lasts one week and is held on the EWAG site in Switzerland. It consists of the following modules:

Module 1, Laser principles:
General laser technology, structure of a laser system, principles of optical systems and properties of laser beams.

Module 2, Laser ablation:
Erosion mechanisms in 2D and 3D erosion, properties of short and ultra-short laser pulses, differences in machining quality.

Module 3, Machine structure:
Description of machine-model constraints of EWAG LASER LINE series, technical questions such as general operation and maintenance of the machine.

Module 4, CAD/CAM:
Basic tool-production skills and basic machining data for machining your geometries. Training on a simple geometry, direct implementation in the course.

Module 5, Cutting edges:
Creation of a typical cutting geometry, direct application on a typical workpiece.

Module 6, Advanced strategies:
Generation of negative chamfers, chip breakers and labelling of workpieces.
EWAG LaserSoft Technology

**BASIS Level**
Intended for users with no knowledge of laser machining, e.g. the second or third shift.

**STANDARD Level**
Ideal for regular users with knowledge of tool machining. Pre-defined calibration and setup data of the machine parameters, which are specified by the HIGH Level user, can be modified.

**HIGH Level**
The surface for the machine operator trained by EWAG with existing knowledge in the design of tools and laser-based machining procedures. The HIGH Level user sets up new tools and can perform modifications on the tool and laser parameters.
From the contour to the tool

New tool idea
The idea for a new tool typically arises from a desired workpiece contour, e.g. from a contour to be milled. This profile is often described as a 2D contour line (marked in red) in the form of a file in DXF format.

Laser Pro 3D
In a first step, the desired contour line is supplemented with the remaining contour lines of the PCD plate to be soldered in.

The clearance angles are now being modelled. Axial or radial angles of the plate are not required for this process.

Next, three measurement points for the measurement of the solder error are set directly in the 3D model (blue points). These are then saved in a file (in EWAG EGI format).

Next, the CAM calculations are performed and the corresponding pathway points (red points) are also saved in a file (EGI format).

EWAG LaserSoft
Now a setup program is created on the machine (HIGH Level). The measurement points and the CAM pathways are now linked directly as machining file.

Finished tool
After the production of the tool, it can be viewed directly on the machine for visual inspection under the integrated camera.
FANUC control unit, the global standard

- Multi-processor system – high system security
- FANUC bus for digital drives – fault-free communication
- CNC and robots from a single manufacturer – no interface problems

With the FANUC control unit, EWAG relies on the global standard of control technology. For the user, this means the highest degree of reliability, availability and operating comfort.
Customer Care

WALTER and EWAG deliver systems and solutions worldwide for all areas of tool machining. Our claim is based on ensuring maximum availability of our machines over their entire service life. For this we have thus bundled numerous services in our customer care program.

From “Start up” through “Prevention” to “Retrofit”, our customers enjoy tailor made services for their particular machine configuration. Around the world, our customers can use helplines, which can generally solve a problem using remote service. In addition to that, you will also find a competent service team in your vicinity around the world. For our customers, this means:

- Our team is close by and can quickly be with you.
- Our team will support you to improve your productivity.
- Our team works quickly, focuses on the problem and its work is transparent.
- Our team solves every problem in the field of machining tools, in an innovative and sustainable manner.
Technical data, dimensions

**Mechanical axes**

<table>
<thead>
<tr>
<th>Axis</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>X axis</td>
<td>440 mm</td>
</tr>
<tr>
<td>Y axis</td>
<td>140 mm</td>
</tr>
<tr>
<td>Z axis</td>
<td>170 mm</td>
</tr>
<tr>
<td>Rapid motion</td>
<td>15 m/min</td>
</tr>
<tr>
<td>B axis</td>
<td>± 110°</td>
</tr>
</tbody>
</table>

**Optical axes**

- Max. scanning field size: 50 x 50 mm²
- Automatic focus position displacement: ± 4 mm
- Max. beam deflection speed: 10 m/s

**Laser source**

- Performance of industrial ultra-short pulse lasers: Standard/High Power
- Wave length: 1.064 nm
- Repetition rate: 0.2 – 1 MHz
- Pulse duration: < 15 ps
- Beam profile and quality: TEM00 (M2 < 1.5)

**Accuracy**

- Linear resolution: 0.0001 mm
- Radial resolution: 0.0001°

**Smoke gas suction/filter system**

- Volume flow: 170 m³/h
- Low pressure: 2,800 Pa
- Dust filter/Filter module: HEPA H14

**Others**

- Power consumption at 400 V/50 Hz: approx. 11 kVA
- Weight incl. robot cell: approx. 4,000 kg

### Tool data

#### Automatic clamping system for indexable inserts

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. inner circle of indexable inserts</td>
<td>3 mm</td>
</tr>
<tr>
<td>Max. circumscribed circle of indexable inserts</td>
<td>50 mm</td>
</tr>
</tbody>
</table>

#### Automatic clamping system for rotationally symmetrical tools

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>HSK 63 A</td>
</tr>
<tr>
<td>Max. diameter of rotating tools</td>
<td>200 mm</td>
</tr>
<tr>
<td>Max. tool length</td>
<td>250 mm</td>
</tr>
</tbody>
</table>

**Options**

- Water reverse-flow cooling unit
- Automation with FANUC robot
- HSK 63 rack
- pallets for rotating tools
- pallets for indexable inserts
- pallet changers
- Customised clamping solutions
- Shaft tools using double grippers and WALTER pallet system

**Services**

- LASER LINE ULTRA training
- Development of customised tools
- Development of spiralised tools in the diameter range of 0.5 – 3 mm upon customer order

All brands marked with ® are at least registered as a basic brand in Switzerland or in Germany, legally qualifying them to carry the symbol.

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1) Linear max. CNC speed in X/Y, this is limited to 5 m/min.

2) The maximum tool dimensions depend on the type of tool and its geometry, as well as the type of machining.

3) From surface contact HSK 63 interface.

Subject to modifications due to technical progress and errors. No guarantee is provided for this information.
Creating Tool Performance

WALTER and EWAG are globally acting market-oriented technology and service companies, and are system and solution partners for all areas of tool machining. Our range of services is the basis for innovative machining solutions for practically all tool types and materials typical for the market with a high degree of added value in terms of quality, precision, durability and productivity.

1) Maximum tool dimensions are dependent on the tool type and geometry, as well as the type of machining.
2) From the theoretical taper diameter of the workpiece holder.

Use: 
- Production
- Regrinding
- Measuring

Materials: 
- HSS High speed steel
- KC Tungsten carbide
- KG Cermet/ceramics
- CKD Cubic boron nitride
- PKD Polycrystalline diamond
- CVD Chemical vapour deposition
- MCD/ND Monocrystalline diamond/natural diamond

Eroding – Electrical discharge machining and grinding of rotationally symmetrical tools

<table>
<thead>
<tr>
<th>WALTER machines</th>
<th>Use</th>
<th>Materials</th>
<th>Tool dimensions</th>
<th>Indexable inserts</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELITRONIC ESSENTIAL</td>
<td>P</td>
<td>HSS</td>
<td>255 mm / Ø1 - 100 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>HELITRONIC MINI POWER</td>
<td>P</td>
<td>HSS</td>
<td>255 mm / Ø1 - 100 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>HELITRONIC MINI AUTOMATION</td>
<td>P</td>
<td>HSS</td>
<td>255 mm / Ø1 - 100 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>HELITRONIC RAPTOR</td>
<td>P</td>
<td>HSS</td>
<td>280 mm / Ø3 - 320 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>HELITRONIC POWER 400</td>
<td>P</td>
<td>HSS</td>
<td>520 mm / Ø3 - 315 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>HELITRONIC VISION 400 L</td>
<td>P</td>
<td>HSS</td>
<td>420 mm / Ø3 - 315 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>HELITRONIC VISION 700 L</td>
<td>P</td>
<td>HSS</td>
<td>700 mm / Ø3 - 200 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>HELITRONIC MICRO</td>
<td>P</td>
<td>HSS</td>
<td>120 mm / Ø0.1 - 12.7 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
</tbody>
</table>

Measuring – Contactless measurement of tools, workpieces and grinding wheels

<table>
<thead>
<tr>
<th>WALTER machines</th>
<th>Use</th>
<th>E1-Value</th>
<th>Tool dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELICHECK ADVANCED</td>
<td>P</td>
<td>(1.8 + L/300) µm</td>
<td>420 mm / Ø1 - 320 mm</td>
</tr>
<tr>
<td>HELICHECK PRO</td>
<td>P</td>
<td>(1.2 resp. 1.4 + L/300) µm</td>
<td>300 mm / Ø1 - 200 mm</td>
</tr>
<tr>
<td>HELICHECK PRO LONG</td>
<td>P</td>
<td>(1.2 resp. 1.4 + L/300) µm</td>
<td>730 mm / Ø1 - 200 mm</td>
</tr>
<tr>
<td>HELICHECK PLUS</td>
<td>P</td>
<td>(1.2 resp. 1.4 + L/300) µm</td>
<td>300 mm / Ø1 - 200 mm</td>
</tr>
<tr>
<td>HELICHECK PLUS LONG</td>
<td>P</td>
<td>(1.2 resp. 1.4 + L/300) µm</td>
<td>730 mm / Ø1 - 200 mm</td>
</tr>
<tr>
<td>HELICHECK 3D</td>
<td>P</td>
<td>(1.8 + L/300) µm</td>
<td>420 mm / Ø3 - 80 mm</td>
</tr>
<tr>
<td>HELISSET PLUS</td>
<td>P</td>
<td>–</td>
<td>400 mm / Ø1 - 350 mm</td>
</tr>
<tr>
<td>HELISSET</td>
<td>P</td>
<td>–</td>
<td>400 mm / Ø1 - 350 mm</td>
</tr>
</tbody>
</table>

Software – The intelligence of tool machining and measuring for production and regrinding

Eroding – Grinding of rotationally symmetrical tools

<table>
<thead>
<tr>
<th>WALTER machines</th>
<th>Use</th>
<th>Materials</th>
<th>Tool dimensions</th>
<th>Indexable inserts</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELITRONIC DIAMOND EVOLUTION</td>
<td>P</td>
<td>HSS</td>
<td>185/255 mm / Ø1 - 165 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>HELITRONIC RAPTOR DIAMOND</td>
<td>P</td>
<td>HSS</td>
<td>270 mm / Ø3 - 400 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>HELITRONIC POWER DIAMOND 400</td>
<td>P</td>
<td>HSS</td>
<td>520 mm / Ø3 - 380 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>HELITRONIC VISION DIAMOND 400 L</td>
<td>P</td>
<td>HSS</td>
<td>420 mm / Ø3 - 315 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
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</tbody>
</table>

Grinding – Grinding of indexable inserts

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<tr>
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<th>Indexable inserts</th>
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</thead>
<tbody>
<tr>
<td>COMPACT LINE</td>
<td>P</td>
<td>HSS</td>
<td>250 mm / Ø0.1 - 200 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>LASER LINE ULTRA</td>
<td>P</td>
<td>CKD</td>
<td>250 mm / Ø0.1 - 200 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>LASER LINE PRECISION</td>
<td>P</td>
<td>CKD</td>
<td>250 mm / Ø0.1 - 200 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
</tbody>
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Grinding – Grinding of rotationally symmetrical tools

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<tr>
<td>LASER LINE ULTRA</td>
<td>P</td>
<td>CKD</td>
<td>250 mm / Ø0.1 - 200 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
</tr>
<tr>
<td>LASER LINE PRECISION</td>
<td>P</td>
<td>CKD</td>
<td>250 mm / Ø0.1 - 200 mm</td>
<td>Ø 3 mm / Ø 50 mm</td>
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